THE

CHEMIST.

VOL. II.

" ——— Search, undismayed, the dark profound
Where Nature works in secret; trace the forms
Of atoms, moving with incessant change
Their elemental round; behold the seeds
Of being, and the energy of life,
Kindling the mass with ever-active flame;—
Then say if nought in these external scenes
Can move thy wonder?——"

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NOTICE.

THE present sheet, consisting of the Index, Title-page, &c. completes the Second Volume of the CHEMIST, and closes the existence of the work. The manufacture of books, and more especially of Periodicals, is undertaken, like all other manufactures, for the sake of profit, and cannot be continued unless those who carry it on are sufficiently remunerated. It has now been ascertained, by a whole year's experience, that the CHEMIST is not likely to *pay*, and therefore the Publishers find themselves compelled to stop it.

In announcing this determination to his readers, the Editor can but express his regret; for his labours have been lightened by some useful contributions, and sweetened by repeated commendation. Neither can he take leave of his Readers and Correspondents with-

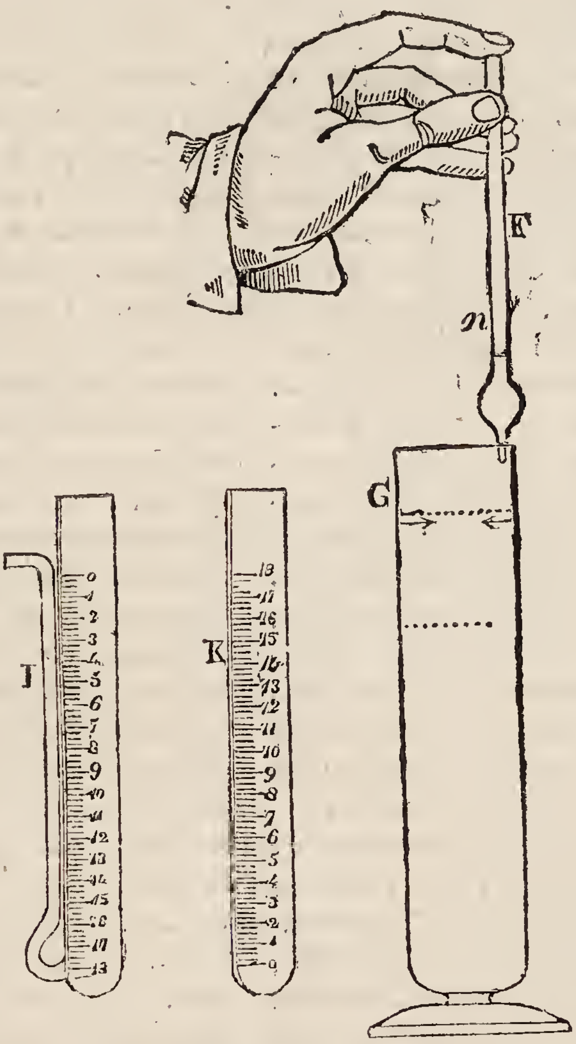
out returning both his sincere thanks; the former for the favour with which they have honoured his efforts to assist in the promotion of knowledge,—and the latter for their contributions. In bidding them all at present a hearty and cordial farewell, his regret is diminished by the hope that their separation will not be final, and that he may soon again have the pleasure of receiving their support to some undertaking more worthy, than the CHEMIST has been found, of public patronage.

TO CORRESPONDENTS.

If our Constant Reader "H. M. G." wishes to make artificial gems to any extent, he had better purchase the powder or purple of Cassius ready made, as it is much used in enamel painting and in tinging glass. It may be made by immersing a piece of tinfoil in a dilute solution of muriate of gold, which throws down a purple powder—the purple of Cassius.

The Chemist.

No. XXIX.] SATURDAY, SEPTEMBER 25, 1824. [Price 3*d*.



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THE CHLOROMETER, OR BLEACHING-POWER MEASURER.

Such is the name which M. Gay Lussac, the French chemist, has given to an instrument adapted to the very useful purpose of ascertaining the bleaching power and quantity of chlorine contained in any of the ordinary combinations of this substance with the alkalies or alkaline earths. Such an instrument or method is likely to be of considerable advantage to the manufacturer, and therefore we shall abridge from the *Annales de Chimie et Physique* for June 1824, M. Gay Lussac's account of the principles of this instrument, and the mode of employing it.

Chlorine, as is well known, destroys vegetable colours, by forming new compounds with their principles. The same quantity of chlorine, whether in a state of gas, held in solution by water, or united with an alkali, destroys the

same quantity of colouring matter; and as, when combined with an alkali, it is fixed, portable, has no smell, and can be more easily preserved, the advantages of having it in this state are very great. Potash, soda, lime, and even carbonated lime, combine readily with chlorine, and when it is combined with either potash or soda, it has long been known in France under the name of *eau de javelle*, and used for bleaching. Chloride (oxymuriate) of potash and of soda are not very fixed, and cannot be obtained but dissolved in a great quantity of water. If the potash be a concentrated solution, and chlorine is conveyed into it, at first chloride of potash is formed, but this is very soon decomposed, and is changed into chlorate of potash and chloride of potassium, neither of which has any bleaching property. This, therefore, should be avoided, which can be done by employing the potash dissolved in a large quantity of water; at most there should not be more than 125 grammes to a *litre* of water, about 4½ ounces to 2¼ pints. Lime does not convert chlorine into chloric acid, and consequently it may, in a solid state, be combined with chlorine. When the lime is perfectly dry it will not absorb chlorine, but it does this rapidly when it contains as much water as it will imbibe from being exposed to damp air, so that it falls to powder. According to Mr. Welter, it forms a subchloride (sub-bichloride of Dr. Thomson,) and if dissolved in water is immediately decomposed; a portion of lime is precipitated, and the other portion combining with the whole of the chloride, remains in solution, forming a neutral chloride. The subchloride then is obtained by saturating the lime in the state of hydrate with chlorine, and the neutral chloride by dissolving the subchloride in water. The neuter chloride, dissolved in water and allowed to remain in contact with the air, is gradually decomposed, the lime combining with the carbonic acid gas of the atmosphere, and the chlorine separating. This decomposition is prevented by constantly keeping an excess of lime in the solution. In consequence, however, of this facility of decomposition, it is more advantageous only to manufacture the subchloride. It may be more easily preserved, and is more portable.

The quantity of chlorine in combination with water, or with a base, may be estimated by several methods; but in the arts the preference is given to that of M. Descroizilles, which is founded on chlorine destroying the colour of indigo. One part of good indigo dissolved in nine parts of concentrated sulphuric acid, and then mixed with 990 parts of water, is in general the coloured liquid by which the trial is made. Under the same circumstances, the chloride of lime destroys the colour of a quantity of this solution in proportion to the quantity of the chloride employed, but under different circumstances different results are obtained. Thus, by pouring the chloride slowly into the solution of indigo, much less is required to produce the same effect than would be if the operation were performed in an inverse manner. The effect is the least when the indigo is poured slowly into the chlorine, and the greatest when the chlorine is poured slowly into the indigo. Repeated trials have proved that the best way to obtain unvarying results, so as to compare them, is to pour either of the solutions rapidly into the other.

The standard which is assumed as unity for the colour-destroying power is pure chlorine, without moisture, at the temperature of 0° cent. (32° Fahr.) under the pressure of 0m. 76c. (29.9.) The best indigo is then taken, and its solution is so prepared that the standard chlorine will destroy the colour of exactly ten times its own volume. This solution is called the test liquid or test tincture. Each volume of the test liquid, or the tenth part, is called a degree, and the degree is divided into ten parts. Thus, when a solution of chloride of lime de-

prives a quantity of this solution, amounting to seven times and six-tenths of its volume of its colour, it is held that the chloride contains seventy-six parts of chlorine, or of the discolouring principle. M. Gay Lussac gives the preference to this base on account of its simplicity and the precision of language which it admits; but it is obvious that the English manufacturer, in having recourse to the instrument and method pointed out by the French chemist, might adopt any scale he pleased. Greater precision is obtained by using a weak solution of the chloride, such as gives, for example, four or five degrees, than with a more concentrated solution. If the chloride should, on a first trial, exceed ten degrees, a known volume of water should be added to it, twice the volume, for example, of the solution; the trial may then be made, and the number of degrees indicated multiplied by three, to have the true strength of the chloride.

To make the examination, it is necessary to have a small accurate pair of scales, and the chloride should be reduced to powder in a mortar. A glass vessel, G, placed on a table quite horizontal, must also be provided, as well as a small instrument for mixing the solution of chloride well, and making it perfectly homogeneous. F is a small measure; on M. Gay Lussac's plan, it contains $2\frac{1}{2}$ cubic centimetres: it is destined to measure the solution of the chloride. In order to fill it, immerse it in the solution of chloride as high as *n*, or make the chloride rise to that mark by suction. When it is filled, place the index, which ought not to be either too wet or too dry, on its upper part; it is then taken out of the liquid, and its lower end being placed on the edge of the glass vessel G, or on the finger, by managing the pressure properly, the liquid descends slowly, and when the lower part has reached *n*, greater pressure stops its further progress, and the exact measure being thus obtained, it is immediately transferred to a common tumbler, in which the experiment may be made. When this measure becomes opaque from use, soak it in vinegar or muriatic acid, and it will be again transparent. I is a small flask or cruet, to measure the test tincture; each degree is equal in capacity to the measure F, and is divided into five parts. This flask is filled as far as 0° with the test tincture, which is done by putting in a little more than is necessary, and pouring off the superfluous quantity, drop by drop. K is a tube graduated like the cruet, but in an inverse manner. It is also destined to measure the test tincture, but only when it is to be poured into the solution of chloride.

To ascertain the strength of a chloride of lime, take from the mass different pieces, in order to have its average quality; weigh a portion, in Gay Lussac's system, five *grammes* of it, pound them in a mortar with water, and pour it into the glass vessel G, which contains, on the French plan, half a *litre*. In performing this part of the operation, take care not to lose or spill any of the liquid, and take care that every particle of chloride is pulverized and dissolved, and the mortar rinsed clean out. Add a sufficiency of water to complete the half *litre*, and agitate it to make the mixture perfectly homogeneous. Fill the cruet with test tincture to 0°, and pour a quantity of it into the tumbler, somewhat less than it is presumed the measure of chloride will deprive of its colour, say a quantity equal to 5°. Take one measure of chloride in the pipe F, and pour it rapidly into the tincture, by blowing into the tube, and in the meanwhile agitate the mixture. If the colour completely disappears, add immediately more of the test tincture from the cruet, till the liquid is slightly green; the quantity of the tincture which has been taken from the cruet will be the measure of the strength of the chloride, supposing that the second portion of the liquid which is added does not amount to more than three-

tenths of a degree. If it amounts to more than this, it is better to repeat the experiment, pouring at the commencement rather more of the tincture from the cruet into the glass than the quantity of which the colour has already been destroyed. Complete the operation as before. The experiment will not be as precise as possible till the test tincture assumes, immediately on the addition of the chloride, without a necessity to add more, the colour already indicated. By these operations, the strength of the chloride to 1-50th part may be ascertained, and though the operations appear complicated, each of them may be executed in two or three minutes; and when the strength of the chloride can be nearly conjectured, two operations are sufficient, and, for the ordinary purposes of the manufacturer, one is enough. The same process is applicable to chlorine held in solution by water; it is better, however, to begin by adding a little quick lime to it, in order to convert it into a chloride. The tube K is intended to make the experiment, by pouring the indigo briskly into the chloride. In this manner of performing the operation, the first object is to ascertain by the cruet how much of the test liquor will saturate one measure of the chloride. The experiment is repeated by putting in K a quantity of liquid somewhat greater than that which has been deprived of its colour, and pouring it rapidly into another measure of the chloride; what is required of the tincture to complete the greenish colour is added. The progress of this method, and its results, are the same as the other, and as it requires in addition the tube K, it is not deserving any preference.

MR. BROWN'S PNEUMATIC ENGINE.

In consequence of the remarks on this subject which we inserted from the *Scotsman* in No. XXVI. of The Chemist, we received a letter from Mr. Brown, complaining that we "had indulged in an unfair, ungenerous, and perhaps injurious attack on his invention;" "that what we called able remarks are founded on wrong data, and that the principle of the invention had been completely mistaken." Mr. Brown concluded his letter by an offer to show us the engine. Willing to do justice to the ingenuity of every individual, as well as promote correct knowledge, we immediately embraced his offer. We have now to state, that in the description we borrowed from the *Scotsman*, there are some errors. In the first place, Mr. Brown does not, in the present engine, employ a piston, and therefore there is no space beneath what does not exist. In the next place, the azote remaining after the combustion does not escape by valves, (though it is so stated in Mr. B.'s own specification,) but the cylinder is open at top while the combustion is going on, and the azote escapes at the top. Of course, therefore, all the reasoning which proceeded on the assumption of the combustion taking place in a close vessel, though accurate in itself, does not at all apply to Mr. Brown's engine. Neither do Messrs. J. and G. Hanson's objections apply to it; for their plan evidently consisted in burning gas in a close cylinder, while Mr. Brown's plan is to burn it in an open one. At the close of that gentleman's letter to us, he pointed out the description of his invention contained in the Monthly Magazine as correct, and in justice to him, therefore, we shall now insert the essential parts of that, with one or two amendments, which Mr. Brown has sent us:—

"From the earliest discoveries connected with gaseous bodies, it was ascertained that all the inflammable gases consume more or less oxygen during their combustion; which oxygen is supplied by the atmospheric air in every case where inflammable substances, either solid, liquid, or gaseous, are employed for yielding artificial light. The two former classes being

in all cases reduced into gaseous matter by the heat of a flame, previous to their giving out light and heat for the purposes of domestic and civil economy.

"Direct experiments have shown us the precise quantity of oxygen consumed by different kinds of inflammable gas. Thus pure hydrogen, at a red heat, unites with, or condenses, *half* its own volumes of oxygen gas, producing a violent detonation, and at the same instant forming a particle of water about the two thousandth part of the bulk of the original gases. Subcarburetted hydrogen, or coal gas, requires, however, for its most perfect combustion, nearly *double* its own bulk of oxygen, or about the proportion of 5 : 9 of the latter.

"The result of which combustion is, a volume of carbonic acid gas, the bulk of the inflammable gas, with a particle of water (or aqueous vapour condensed) as before. Carburetted hydrogen, or oil gas, consumes upwards of *three* times its bulk of oxygen during its combustion, leaving more than two volumes of carbonic acid, and a particle of water or aqueous vapour, according to the temperature of the vessel.

"The mixture of all these gases with their respective proportions of oxygen before mentioned, produces a most violent detonation, accompanied by great expansion. The inflammability of hydrogen gas is such, that when mixed with oxygen in almost any proportion, the union is so instantaneous on applying a lighted taper, that great expansion, followed by the collapse of the ambient air, always ensues. Pure hydrogen is, therefore, a very dangerous agent to employ for any inflammable process, from the uncontrollable violence of its attraction for oxygen.

"But during the consumption of a jet of oil gas or coal gas for giving artificial light, the supply of oxygen from the atmosphere air is so gradual, that we obtain a *combustion* without *explosion*.

"Now this distinction forms in reality the basis of the principle of Mr. Brown's new engine. *A given quantity of inflammable gas being admitted into a metal cylinder of known dimensions, it combines with the atmospheric air in such proportion as to form nearly a perfect inflammation, without producing either an explosion or a dangerous expansion.*

"Now it is obvious that a very near approximation to a *perfect vacuum* will be the result of the *flame filling the whole cavity of the cylinder*, and thereby expelling (as in the experiment of the cupping-glass) the whole of the atmospheric air, except the oxygenous portion, which is essential to the production of flame. But one half of this oxygen becomes *absolutely condensed* by uniting to the inflammable gas, and forming water; whilst the azote or nitrogen, which forms about four-fifths of the atmospheric air, will be expelled from the cylinder by means of the flame: the residuum, in the cylinder after the combustion being a small portion of carbonic acid gas.

"The point of *complete condensation* between the strokes, therefore, which has hitherto formed the grand desideratum with all the inventors and improvers of steam engines, is effectually accomplished by this ingenious combination of Mr. Brown.

"In order to set this engine in action, nothing more is necessary than to turn on the gas by stopcocks, and light it. Suppose the beam to be in equilibrio—by pressing down one of the cylinder-caps on the head of the cylinder, the opposite end of the beam will become elevated, and by means of a rod, will open the sliding valve in the side of one of the cylinders, and at the same instant open the stop-cock of the gas-pipe, when the gas will immediately rush into the lower part of the cylinder, and become instantly ignited.

"But the upward motion of the beam end also opens a sliding valve, (which covered the orifice of the pipe) so as to allow the atmospheric air to act on the surface of the water in the tank and chamber.

"The combustion of the gas in

the cylinder being effected, and the flame expelling the azote and destroying the oxygen, having produced a vacuum, the atmospheric pressure on the surface of the water below forces it through the pipe into the main and cylinder, and over the top rim of the interior cylinder, filling the whole of the interior cylinder. But whilst the water is passing up the pipe and main, it also drives up the float, which by its rod forces up the end of the beam, and of course brings down the opposite end so as to close the cylinder with a cap air tight. *It is therefore the extinction of the flame by closing the top of the cylinder, which actually produces the vacuum;* whilst at the same instant the water from below rushes up with vast rapidity to fill its space in the cylinder. The water is discharged from the cylinder into the trough, by admitting the atmospheric air through the horizontal pipe. This is effected by the minor beam drawing the slider of the valve immediately the cylinder becomes filled with water. The air rushing in, relieves the pressure on the cap, and allows the reciprocal action of the beam and floats to proceed for the alternate stroke, whilst the water by its own gravity descends from the cylinder through the pipe and trough, to be applied to a water-wheel or any other arrangement requisite for economical purposes.

"From the silent action of this engine, the spectator is in a measure surprised at the powerful effects produced. And it is only by an inspection of the mercurial gauge attached to the engine, that he can imagine the vacuum effected (and consequently the power gained by the correspondent pressure of the air) to be so great as it is in reality. It is not probable that the stop-cocks, valves, &c. of this, which is only a model engine, are so perfect as they might be made by the workmanship of our excellent engineers of the present day; yet Mr. Brown at present produces a vacuum = twenty-two inches of mercury by the gauge. And this being equal to a reduction of eleven-fifteenths of the atmospheric pressure, it is not improbable that, when these engines become constructed with every attention to the workmanship, a much more perfect vacuum will be obtained."—*Monthly Magazine.*

In conclusion, we have to remark, that the mistakes have arisen from the manner in which Mr. Brown's specification was drawn up, it being there stated that the "cylinder is closed air-tight;" after which it is added, that "the gas continues to flow into it for a short space of time, then it is stopped off; during that time, by its combustion, it acts on the air within the cylinder, and at the same time a part of the rarefied air escapes through *one or more valves*, and thus a vacuum is effected;" while, in point of fact, the greater part of the combustion takes place in an open, and not in a closed air-tight cylinder. The particular passage of the observations which we took from the *Scotsman*, to which Mr. Brown took most objections, was that in which the engine is spoken of as a *deception*. We are, for our own parts, quite satisfied that this word was used with no invidious meaning, but that the writer supposed Mr. Brown to be himself labouring under a mistake. The passage we have just quoted clearly points to combustion in a closed cylinder; and this gentleman can have no just cause of complaining of another for a misapprehension which originated in his own specification. Nobody who has seen the engine can deny it to possess great mechanical ingenuity; but this does not come within our sphere. The chemical principle involved in it, and the moving power of the machine, is the production of a vacuum; and that this should be accomplished by *combustion in an open vessel*, which is closed as the combustion is completed, to the degree stated in the passage quoted, is a novelty perfectly unlooked for in science, and quite contrary to many received notions. We must, however, say, after having seen the

engine at work, that this appears to be accomplished; but other persons may well be excused for misapprehending the nature of the invention, since the inventor's own specification is calculated to convey an erroneous idea of the principle of the engine.

FLOWERS COVERED BY SUBLIMATION.

INTO a large glass jar, inverted upon a flat brick tile, and containing near its top a branch of fresh rosemary, or any other such shrub, moistened with water, introduce a flat thick piece of heated iron, on which place some gum benzoin in powder. In consequence of the heat the benzoic acid will be separated and ascend in white fumes, which will at length condense, and form a most beautiful appearance upon the leaves of the shrub. Other substances may be substituted for benzoin, when the effect will be different. The skilful young chemist will, we have no doubt, discover many applications of this effect of sublimation.

TO MAKE TIN RESEMBLE SILVER.

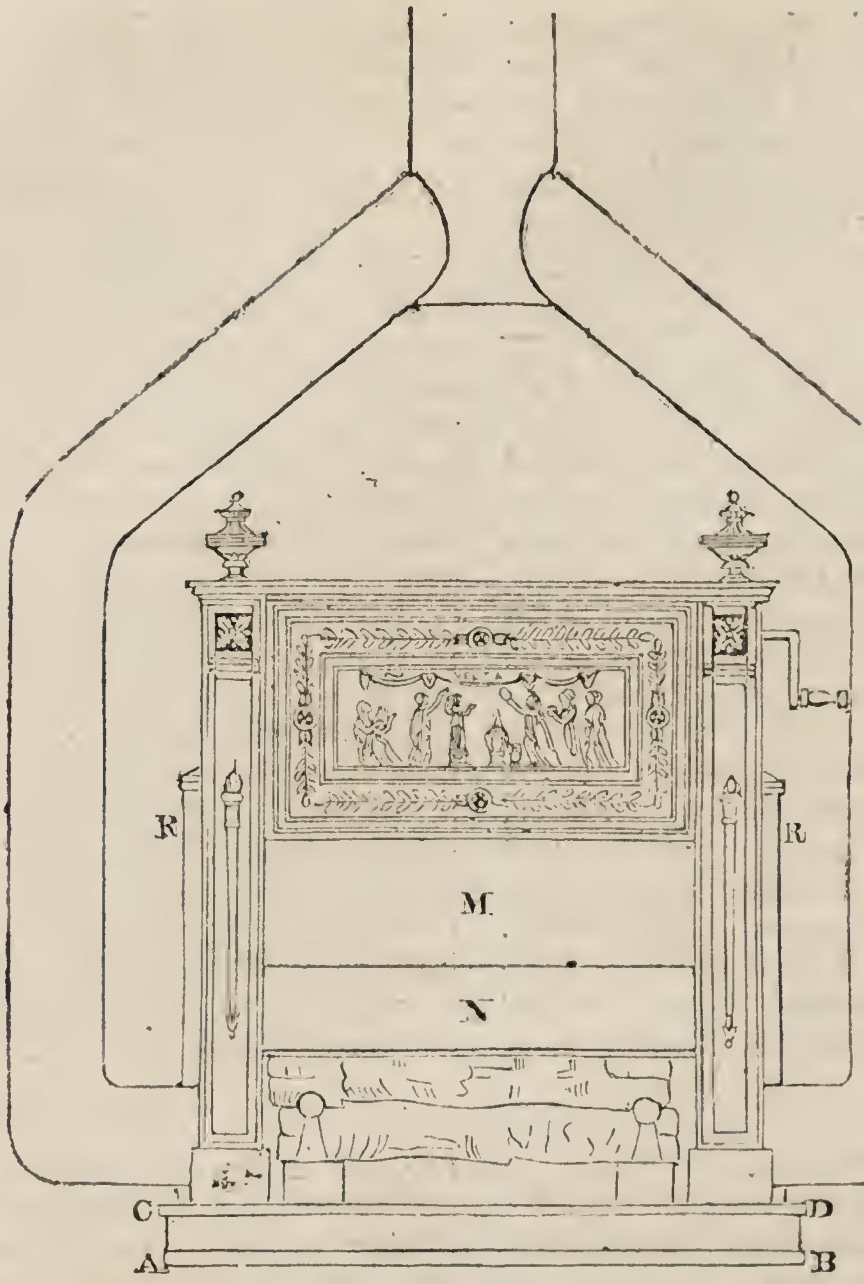
MELT four ounces of fine plate brass, and add to it four ounces of soft fine clear tin; when it is in fusion, add four ounces of bismuth and four ounces of regulus of antimony. Let this flux together, and pour it out into an ingot; then beat it to powder; grind it with rosin, a little sal ammoniac, and turpentine; form it into balls, and let them dry in the air; and when you would use them, beat them fine. Strew the powder thereof upon the melted tin; stir it well together, and continue putting the powdered balls upon the melted tin until you perceive it white and hard enough. Of this tin you may draw wire for hilts of swords, or make buttons: it will always retain its silver colour.—*Mechanic's Magazine.*

QUALITY OF BARK.

A GERMAN author, Dr. Michaelis, has lately published the result of some experiments he made by means of muriatic acid, quick lime, and alcohol, to ascertain the quantity of *cinchonina* and *cinchona*, the active febrifuge principles contained in different species of bark. We are not quite sure that the specification of the different kinds will enable our readers to distinguish them, as English and Continental authors are not yet agreed on the names of the different kinds of bark; but still, as the estimate may be of some use, we shall transcribe it.

		Cinchonina	Cinchona
One pound weight of	*China rubra* gave	32 grs.	64 grs.
	China loxa	18	8
	China fusca	75	75
	China fusca, superfine, of *Huamuco*, at 3 rix drs. the lb.	50	32
	Do. do. at 2¾ rix dollars	74	28
	China fusca, superfine, of *Huamalies*, at 2¼ rix drs.	0	12
	Do. do. at 1 rix dollar	48	28
	Do. do. at 14 groschen	60	34
	China fusca tenn. superfine	12	44
	China fusca tenn. middle kind	12	80
	China flava Carthagena	28	48
	China regia, rolled		154
	China regia, flat, not doubled		286

Whence the last, or the *China regia*, is recommended for medicinal purposes.



DESARNOD'S FIRE-PLACES.

There is from long custom so great a desire among all ranks in England to see the fire which warms their apartments, that the most convenient, cleanest, and cheapest method of heating them is sacrificed to this single circumstance. Having ourselves experienced the effect of heating rooms by air and by ovens, we have no hesitation in saying, that either of these, where the slightest attention is paid to cleanliness, is far preferable to the common method of heating rooms by open fire-places. The great objection to ovens is, that they do not necessarily occasion a renewal of the air, which is, therefore, very often foul and unhealthy. This, it is obvious, may be remedied by attention; and it is very common in the midst of winter, for the inhabitants of Germany to sit in their stove-heated rooms with a window open. The tendency of the heated air being to escape, there is in point of fact no draught in such apartments; but the currents of air in rooms heated after the English mode are quite an annoyance, independent of which, as the individuals are always between the fire-place and the source of the supply of air, it is quite impossible to preserve an equality of temperature; sometimes even one part of the body is roasting while the other is freezing. But as people will not give up a sight of the fire for other conveniences, inventors are obliged to adapt their contrivances to this disposition, and labour to reconcile the sight of a brilliant fire with the consumption of the smallest possible quantity of fuel, with the least draught *in the apartment*, with a regular supply of fresh air, and the greatest regularity of tempera-

Fig. 1.

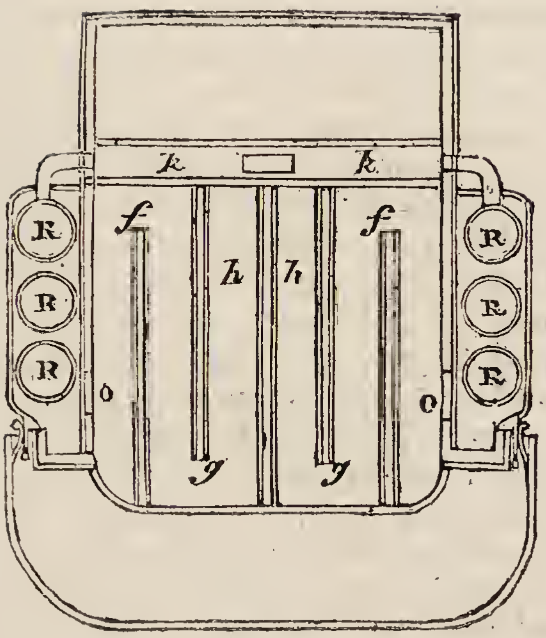
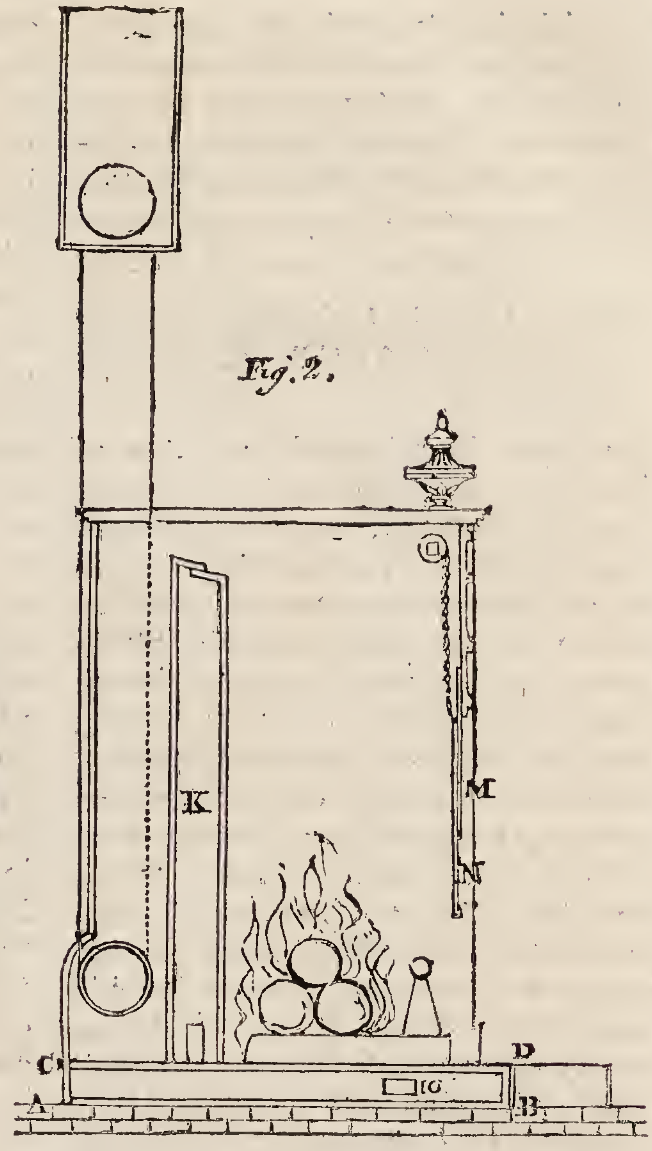


Fig. 2.



ture. The fire-places of M. Desarnod are said, in the *Dictionnuire Technologique*, to answer these purposes, which makes us lay a description of them before our readers. A B, which forms the base of these fire-places, is a plate of cast iron laid on brick-work, which is open, and allows the air to enter frecly from the outside, by a funnel made in the pavement, or some convenient part of the wall, without passing through the room, and to circulate round the fire-place. Over A B another plate, C D, is laid, and between them several perpendicular divisions are made by plates of cast iron, but so as to admit the air, which enters from beneath A B by the holes, *o o*, Fig. 1, to take the direction *f g h*, and then pass into a space between two other plates, K K, placed perpendicularly in the back part of the fire-place. From between these two plates the air now heated passes on each side of the fire-place into the tubes or pipes, R R, which project into the apartment, and are provided with doors or valves, which may be opened or shut at pleasure, to permit the heated air to enter the room. This air supplies the place of that which is consumed by the fire; and the current is so much stronger, through the funnel communicating immediately with the atmosphere, that it entirely prevents all draughts through the doors or windows. By means of two plates, M N, which slide on one another, the access of air to the fire-place may be regulated, so as to increase or retard the combustion of the fuel. The figure, showing a front view of this construction, must satisfy the reader that it may be made of any requisite degree of elegance. We are inclined, however, to suppose, that it would be an improvement on this plan to have a direct communication from the space between A B and C D with the fire, so that the combustion might also be in part kept up by the air derived from the funnel communicat-

ing with the atmosphere. The great apparent utility of fire-places on this principle is, that we have a sight of a cheerful fire without being exposed to any draught from the air which supports the combustion.

ANECDOTES OF ROUELLE, A CELEBRATED FRENCH CHEMIST.

We have just lost the creator of chemistry in France.* William Francis Rouelle, apothecary and demonstrator in chemistry at the Royal Botanic Gardens, a member of the Royal Academies of Sciences, at Paris and at Stockholm, died the beginning of this month, after a long and painful illness. Rouelle was a man of great genius without cultivation; before him nothing was known in France but the principles of Lemery: it was he who introduced the chemistry of Stahl, and made known in his country a science of which it was wholly ignorant, but in which such rapid advances had been made by a number of great men in Germany. Rouelle was not able to read all their writings; but his native genius was sufficient to lead him on, almost without assistance, so that he ought, in justice, to be considered as the founder of the science in France. His name will, however, soon be forgotten, since he has not written any thing; and those who have written upon the subject, and who are all his scholars, have not, in their writings, rendered that homage to their master which was his due: they have found it more expedient to take to themselves principles and discoveries which they held from him. Rouelle, for this reason, quarrelled with all those among his disciples who wrote upon chemistry. He revenged himself for their ingratitude by the reproaches with which he loaded them in his public and private lectures; and it was always known beforehand, that at such a lecture the portrait of Malouin would be given; at such a one the portrait of Macquer, in colours suited to the indignation of the lecturer. They were, according to him, ignorant blockheads, barbers, apprentices, *plagiarists*. This last appellation had, in his mind, a signification so odious, that he could say nothing beyond it; he used to apply it even to the greatest criminals; and to express the deep horror he felt at Damien's attack upon the King, he could find nothing worse to say of the culprit than that he was a *plagiarist*. His indignation at the plagiarisms which had been practised upon himself, grew at length to a sort of mania: he always thought himself plundered; and when the works of Pott, of Lehmann, or any other great German chemist were translated, in which he found ideas analogous to his own, he asserted that he had been pillaged by them.

Rouelle was, by nature, extremely petulant; his ideas were confused, and without precision, and it required a good head to follow him in his lectures; he spoke with great eagerness, but incorrectly, and was accustomed to say of the Academy, that there was nothing there but *fine talking*. Notwithstanding these defects, his views were always profound, and those of a great original genius; but he sought to veil them over to his auditors, as much as his natural impetuosity would allow him. He commonly was very diffuse in explaining his ideas; but even when he had been the most so, he would conclude with saying, "but this is one of my arcana, which I do not disclose to any body." Sometimes one of his pupils would rise and repeat to him, in a whisper, all that he had himself been saying aloud; Rouelle then believed that the disciple had discovered his *arcanum* by his own penetration, and would entreat him not to divulge what he had just demonstrated to two hundred auditors. He was so uncommonly absent, that exterior objects had scarcely any existence to him. When he was talking he fidgetted about upon his chair like one possessed,

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* He died in 1770.

threw himself backwards and forwards, flourished his arms, perhaps gave his neighbour a kick with his foot, or tore his ruffles without being the least sensible of what he did. One day, being in a circle where there were a number of ladies, he untied his garter, drew his stocking down over his shoe, scratched his leg for some time with both his hands, and then replaced his stocking and garter, being all the time unconscious of the absurdity of such conduct. At his lectures, he usually brought with him a brother and a nephew to assist him in his experiments; but as his assistants were not always there, he would cry, "nephew! why nephew!" but the nephew not coming, he would go himself to the laboratory, always continuing his lecture as if he had still been with his auditors, and, at his return, had commonly finished the demonstration he was then about, concluding, according to his usual custom, with, "Yes, gentlemen." One day, in the absence of his brother and nephew, being left to perform the experiments by himself, he said, "Gentlemen, you see this cauldron upon this brazier. Well, if I were to cease stirring a single moment, an explosion would ensue, which would blow us all into the air. This was no sooner said than he forgot to stir, and his prediction was accomplished; the explosion took place with a horrible crash, all the windows of the laboratory were smashed to pieces, and two hundred auditors whirled away into the garden. Fortunately, no serious injury was received by any body, the greatest violence of the explosion having been in the direction of the chimney: the demonstrator himself was quit with the loss only of his wig. It is, indeed, almost a miracle, that, making his experiments, as he very commonly did, by himself, because he would not let even his brother into his *arcana*, he was not blown into the air by his heedlessness hundreds of times. By inhaling, however, so perpetually the most noxious exhalations, without taking any precautions to counteract their effect, he, in the end, lost the use of his limbs entirely, and passed the latter years of his life in the most terrible state of suffering.

Rouelle was a thoroughly honest man, but with a character so rugged and uncultivated, he could neither know nor practise the established usages of society; and as it was easy to prejudice him against any one, and impossible ever to remove a prejudice once imbibed, he often, in his lectures, laid around him every way in the most unmerciful manner: it was not, therefore, surprizing that he made himself a great many enemies. He could not admire the physics or the systems of M. de Buffon, and was little affected with the beauty of his style, to which he applied his usual epithet of *fine talking;* some part of every course of his lectures was, therefore, regularly devoted to abusing this illustrious academician. He had also conceived a grudge against Dr. Bordeu, a physician of considerable talents and reputation. "Yes, gentlemen, (he would say regularly every year at some part of his lecture,) he is one of your people, a plagiarist, a smatterer, who has killed my brother that you see here." He always insisted that Bordeu had blundered exceedingly in his method of treating his brother in a severe illness he once had. Rouelle was demonstrator at the public lectures, given at the King's Botanic Garden, Dr. Bourdelin being then professor, who commonly finished his lectures with these words: "As the demonstrator will prove to you by his experiments." But Rouelle then, instead of proceeding to the experiments, said: "Gentlemen, all that the professor has been telling you is absurd and false, as I will prove at this moment;" and, unhappily for the professor, he was commonly as good as his word.

For the rest he was a thoroughly good Frenchman, full of patriotism and zeal for his country, loving news to the heart—when his eyes were not fixed upon a crucible. At

the beginning of the last war he was hot upon commanding a fleet of flat-bottomed boats, with which he would go and burn London. He did not despair of finding the means of setting fire to the English squadrons upon the water: this was one of his *arcana*. I met him the day after the battle of Rosbach; he was altogether in a fermentation, and seemed to walk with the utmost difficulty. "Hey! how's this; what is the matter M. Rouelle?" said I. "I am ground to powder; (said he) I can support it no longer; the whole Prussian cavalry has marched this night over my body." He aftewards abused our generals as *plagiarists*, and I felt that this was not a moment to combat his opinion. Great political and military events affected him so strongly, that he would even, sometimes, descant upon them in the midst of a lecture on chemistry.

Among the number of his disciples may be reckoned, not only all the able chemists that France can boast at this day, but a number of celebrated men in other classes of science. Independently of his deep knowledge in chemistry, he had an art, which most truly belongs to great genius, that of leading his disciples to think. Dr. Roux, who studied under him for a long time, has always proposed to collect his papers after his death, and arrange them in such a manner as to give them all the requisite clearness and order, and then present them to the public as a treasure which had belonged to his master. He knows many of his *arcana*, which will be forgotten with the name of their author, if this project be not carried into execution.—*Grimm's Memoirs.*

PRINCIPLES OF COFFEE ROASTING.

(*Mr. Evans's New Method.*)

In the thirteenth Number of our Work, page 196, we gave a short account of the mode in which coffee is cultivated; and having lately met with a description of a new method of roasting it, for which a patent has been taken out by a Mr. Evans, we shall now give a description of this, and of the constituent parts of coffee. From the experiments of Cadet and Hermann, it appears that the following substances may be obtained from this berry. The former of these gentlemen found that 64 parts yielded—

Gum . .	8. 0
Resin .	1. 0
Extract and bitter principle .	1. 0
Gallic acid .	3. 5
Albumen .	0.14
Fibrous insoluble matter .	43. 5
Loss . .	6.86
	64. 0

We are indebted to Mr. Chenevix for the discovery in coffee of a bitter principle, to which the name of *caffein* has been given, which is soluble in water and alcohol, the solution having a pleasant bitter taste. Dr. Thomson states also, that when coffee is roasted, a portion of *tannin* is formed in it by the action of the heat; and that a new substance having a peculiar, agreeable smell is developed, but its nature has *not yet been ascertained.* It is developed also by *roasting* barley, beans, and a great variety of other vegetables, which are occasionally substituted for coffee. All coffee drinkers know perfectly well, that the flavour of their beverage depends in a great measure on the manner in which the berries are roasted; but we cannot say that any scientific experiments have hitherto been made to determine precisely the changes which coffee undergoes during this process. There can be no doubt, however, from the different smells which arise as the change is going on, that it is chemical. In the description of the method of manufacturing pyrolignous acid, which appeared in No. XVII. of The Chemist, we pointed out the fact of the elementary principles of vegetable sub-

stances, when subjected to different degrees of heat, entering into other combinations, and forming compounds not before met with in the vegetable. Now the substances we have mentioned above were detected in raw coffee; and it does not appear that those which are formed by the roasting have been so accurately examined. M. Payssé, indeed, found that distilled coffee yielded an *acidulous water*, a *thick brown oil*, and *carbonate of ammonia*.* We are, in fact, yet in the dark as to the changes which coffee undergoes in the roasting, and only know, from very imperfect practical results, what is apparently the best method of roasting it. Count Rumford, indeed, instituted some experiments on the subject, but, without ascertaining the changes produced by the operation, came to a practical conclusion, that only a small quantity of coffee should be roasted at once; that the heat should not be great; and that the process should be conducted in a thin glass retort. The one used by the Count had a long neck, and was closed with a *cork, having a small aperture at the side*, and projecting so far that it might be used as a handle in turning the retort round while exposed to the action of the heat. But though this is, probably, a very good plan for the amateurs of coffee, or for those who choose to be at the trouble of roasting it themselves every second or third day, it will never answer for the manufacturer or coffee roaster. The Count recommended, that not above half a pound should be roasted at a time, which would require one person in every third family to roast coffee every day, causing a prodigious waste of time and trouble. Under these circumstances, it is, therefore, to be wished, that the changes which coffee undergoes in burning should be more correctly ascertained, and the best mode of burning it on a large scale adopted.

The account of Mr. Evans's experiments, and the machine they led him to invent, seem to correspond with both these objects. It is sometimes the practice in England, under the notion of saving as much as possible, to burn the coffee in close vessels; but it results from the experiments above mentioned, as well as those of Mr. Evans, who, by the bye, appears never to have heard either of Count Rumford or M. Payssé, that the first product of the roasting is an acidulous water. It is indispensable to get rid of this. Coffee roasted in close vessels is found, by retaining it, to become very soon soft, and to lose, by a further decomposition occasioned by this acid, a considerable portion of its flavour, so as ultimately to become tasteless. By an ingenious contrivance, which corresponds in principle perfectly, though on a large scale, with Count Rumford's *long cork* with a slit on one side, and adapted to rotatory roasters, which can be made of any size and of different forms, and to which heat can be applied in any required degree, Mr. Evans roasts his coffee so as to permit freely the escape of this acidulous water. The mechanical means by which this is accomplished, are as follow:—The axis of the roaster is hollow, and does not pass through it, but is divided into two portions, each of which is fixed to the end of the roaster by flanges. Into the hollow of the axis a tube is introduced, perforated towards the interior part with a number of small holes at the sides, while it is closed at the end, which serves as a chimney to carry off the acid liquor and vapour. Soon after the machine is placed over the fire, a dense steam, consisting of this acid substance and water, escapes.

But coffee also contains a *thick brown oil*, and the bitter principle, which are soluble in water and very fragrant, and to which the fibrous and insoluble matter of the coffee owes its agreeable taste and refreshing powers. So volatile is this oil, that we are told "the aromatic substance extracted from coffee by boiling water is so feebly united with it, that it escapes into

* Thomson's Chemistry, vol. iv. p. 270.

the air with great facility.—If a cup of the very best coffee, prepared in the highest perfection, and boiling hot, be placed on a table in the middle of a room and suffered to cool, it will, in cooling, fill the room with its fragrance; but the coffee, after having become cold, will be found to have lost a great deal of its flavour. If it be again heated, its taste and flavour will be still further impaired; and after it has been heated or cooled two or three times, it will be found quite vapid and disgusting."* After getting rid, therefore, of the acid, it is of essential importance that as much as possible of this fragrant and peculiar principle of the coffee should be preserved. There is even reason to believe, that it may be much increased by, if it be not altogether the product of, the operation of roasting; as the vinegar from distilling wood and the sugar from malting grain are the result of the changes these substances undergo during the distilling or malting process: certainly, however, it is possible wholly to destroy this fragrance, and to roast coffee so that none of the oil remains, or that none is formed. We know that unless carbonic acid escapes from grain while malting, it is not converted into sugar; and in the same manner it would appear, that unless the acid is driven off from the coffee, this fragrant oil is not formed. It is, therefore, necessary to expel the acid, and produce or preserve as much of the oil as possible. In general, the only means adopted to accomplish this is not to apply too much heat. Count Rumford was so cautious, that he used a glass vessel, in which he could see the process, and which, on being heated beyond what was necessary, melted. Mr. Evans accomplishes this object in a manner superior, we think, to that of the Count. As it is not possible to employ glass for conducting the process on a large scale, he has adapted to his roasters what he calls an examiner, which is introduced through one end of the axis, and is so contrived, that he can take out a portion of coffee at any period of the process, without stopping the rotatory motion of the roaster. When it is found, from the appearance of the berries, from momentarily condensing the steam by a piece of slate held before the chimney, and other circumstances known to practical men, that the acid and water have escaped, and that the oil begins to pass off, by inserting another tube into the perforated tube serving as a chimney, Mr. Evans gradually closes the roaster, and completely prevents the escape of the volatile fragrant oil. In this point the method is superior to Count Rumford's, as he could only lessen the heat or remove the coffee to preserve the oil. By nearly closing up the vessel, however, it is found that the remainder of the process, so as to bring the coffee to a good colour, is more speedily performed, that a less quantity of fuel is necessary, and that a much greater proportion of the fragrant principle of the coffee is retained or created than if the whole process were conducted in an open vessel. By the ordinary methods of roasting, the loss is 8 per cent.; by this new method, the loss is only four, and at the same time the acid is entirely driven off.

By an ingenious application of a swivel or ring, the instant the coffee is found to have been long enough exposed to the fire, the machine is swung away from it, and is continued in motion till the coffee is cooled, while another roaster can be placed over the fire. In consequence of preserving this oily matter in the coffee, it has a glossy shining appearance, as if butter had been put into the roaster; but it never becomes rancid, as coffee so roasted does; and is not likely to become tough and tasteless, like coffee which still retains the acid from being roasted in close vessels, or by the ordinary method. The appearance of the ber-

* Edinburgh Encyclopedia, Article, Coffee.

ries has sometimes led to the supposition, that the coffee was roasted with some substance, or soaked in some liquid; but while the acknowledged existence of an oil in coffee explains this, we know of no substance which would at all answer the purpose attributed to it by this supposition. A great part of the art of roasting coffee, consists in applying the heat gradually and equally to every part of all the berries. In the new method, this is effected by ledges placed diagonally in the roaster, which, as it revolves, turn over every berry. We consider Mr. Evans's coffee-roasting machine to be constructed on correct principles, and have no doubt, that coffee thus burnt will be much superior to that burnt by the ordinary method. It is an improved application, on a large scale, of the priciples pointed out by Count Rumford, though we are assured that Mr. Evans had no knowledge of that gentleman's experiments. Mr. Evans has taken out a patent; and seems to think, correctly we believe, that his machine will be applicable to a number of other purposes, such as the drying, distillation, and decomposition of different vegetable substances. Whether this expectation is well founded or not, we cannot at present decide; but the chemical principles of roasting coffee on which he proceeds are so well established, and his adaptation of mechanical means to carry them into effect so ingenious, that we are persuaded his method will be generally adopted by the manufacturer, and that he will be encouraged by the approbation of all coffee drinkers.

DICTIONARY OF CHEMISTRY.

Cassius's Purple Precipitate. A precipitate produced by adding muriate of tin to muriate of gold; it consists of purple oxide of gold combined with oxide of tin, and is used to give a red colour to porcelain and glass.

Castor. A light brown substance, having a very peculiar smell, found in the inguinal regions of the beaver. Its peculiar smell appears to reside in an essential oil, which is one of its constituent parts. As a medicine it is antispasmodic.

Catechu, *japon earth*, *terra japonica*. A substance obtained by decoction and evaporation, from a species of mimosa, which abounds in India. It is used as a medicine, being a powerful astringent, and is said to be serviceable in diseases of the throat. What is most peculiar about it is, that it contains the largest proportion of *tannin* of any substance we know. One pound is said to be equivalent to seven or eight pounds of oak bark, for the purpose of tanning, or converting hides into leather.

Cat's-eye. A mineral of a beautiful yellowish-green appearance, found in Ceylon, and used as a precious stone. It consists principally of silica.

Caustic Lunar, *lapis infernalis*, *nitrate of silver*.

Celestine, *native sulphate of strontites*.

Cement. A general name for whatever is employed to unite or cement things together, of the same or different kinds, and in this sense it includes *lutes*, *glues*, and *solders*; but it is more usual to restrict its meaning to substances of which the basis is an earth, or earthy salts. In this latter restricted sense even there are a great variety of cements.

Cementation. A chemical process by which iron is converted into steel, and glass into porcelain. The iron is surrounded with charcoal in close vessels, and the glass by sand, and the whole is exposed to a strong heat.

Cerasin. Any gummy substance which swells in cold water but does not readily dissolve in it, has been called cerasin: gum tragacanth is an example.

Cerin. The name given by M. Chevreul to a peculiar substance which precipitates from alcohol that has been digested on grated cork; the name given by Dr. John to the portion of common wax which dissolves in alcohol; also the name of a mineral, a species of allanite.

CERITE. An oxide of *cerium* mixed with silica, iron, and lime.

CERIUM. An undecompounded metal, detected about 1804 in the mineral above-mentioned, and called cerium after the planet Ceres, then lately discovered.

CERUMEN, *ear-wax.* A yellow coloured secretion, which becomes viscid on exposure to the air.

CERUSE, *white lead, carbonate of lead,* prepared by exposing lead to the action of acetic acid.

CETIC ACID. The name given by M. Chevreul to a substance obtained by saponifying spermaceti with potash, and decomposing it with an acid.

CETIN is the name by which the same chemist has distinguished spermaceti.

QUERIES.

THE best method of preparing and stuffing the skins of small birds and quadrupeds?

By what method is wax rendered sufficiently ductile for modelling?

An answer to the above questions will oblige a constant reader.

E. R. W.

ANSWER TO QUERY.

To the Editor of the Chemist.

SIR,—I beg to inform your Correspondent Electricicus, (vol. i. p. 367) that the following is the method pursued by Professor Meinecke, of Halle, and by which he produced a constant light in his apartment, surpassing that of the moon.

Around the place to be illuminated, he arranged what are called in electricity luminous tubes, glasses, &c. i. e. insulating substances, having a series of metallic spangles at small distances from each other, and then by a two feet plate machine he sent a current of electricity through them; he likewise used partially exhausted glasses, as the luminous receiver, conductor, &c. and by enclosing his system of sparks in tubes filled with rarefied hydrogen gas, he found the brilliancy more than doubled.

Should this meet your Correspondent's wishes, a communication on the success of his experiments will oblige

Your constant reader,

P.

P. S. It is somewhat strange, that your German Correspondent should, in his younger days, and in a foreign country, make a figure perfectly resembling Fiddling Billy, alias Billy Waters. Perhaps he will be so kind as to inform *us English* the reason. P.

The explanation desired by our Correspondent is easily given. Our engraver did not copy exactly the drawing of our German Correspondent; and we, seeing in the engraving only a somewhat more amusing figure than the original, allowed it to be struck off. We now, for the first time, learn, from our present Correspondent, that it was a copy.—ED.

TO CORRESPONDENTS.

The letter of James Wright *is unavoidably postponed.*

R. C.*'s suggestions are taken into consideration, and one of the alterations he recommends having before been resolved on, is now, he will see, carried into effect.*

We have to regret that we have been prevented from attending either of the meetings of the Chemical Society. It was our intention to have shown by our presence that we valued highly the compliment paid us. As we have been obliged to postpone our visit, we must now return the Society our thanks for the ticket.

The articles on Chemistry and on Distillation will be continued in our next.

The pamphlet sent by A Subscriber *has been received, and we shall notice the subject, but must, to make the matter clear to our other readers, publish the plate.*

*** *Communications (post paid) to be addressed to the Editor at the Publishers'.*

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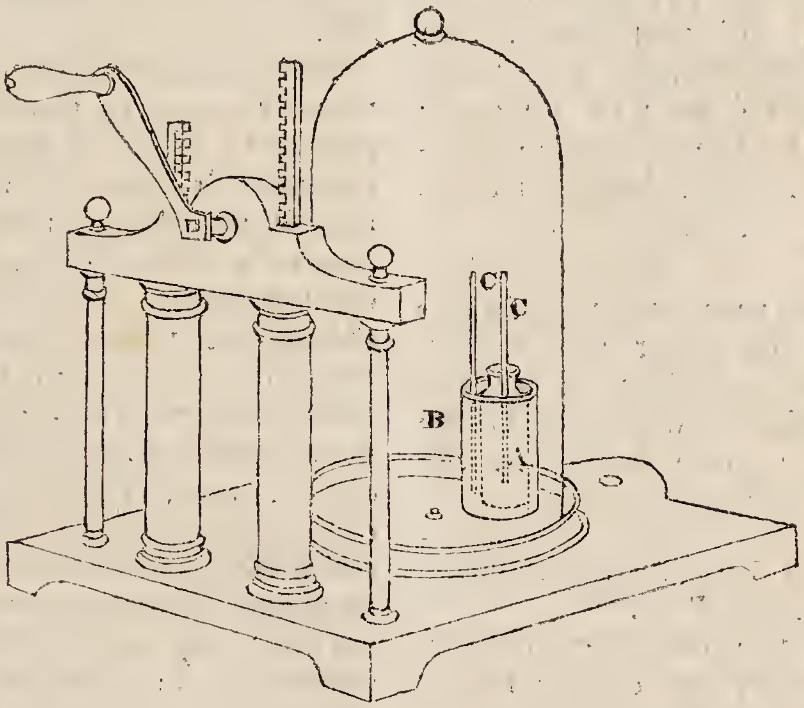

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FREEZING AND BOILING.

Mr. Editor,—Having observed in your 27th Number, a little Article on Freezing and Boiling by the same means, and supposing that some of your youthful readers may possibly want a further elucidation of the subject, I send you a sketch of an air-pump, with a mode of performing this experiment, somewhat different from that you describe. If watch-glasses are employed as you mention, the experiment is performed with more ease and certainty of success; but if the ether be placed in a phial, and that phial placed in a glass vessel only a little larger than it, the experiment is more philosophically amusing and instructive. By using the watch-glasses, or a piece of tin and a watch-glass, you may certainly find them adhering together by the ice which is formed, but there is a difficulty in fixing thermometers, so as to show the temperature of the ether and water. By using a phial and a glass, a thermometer may be placed in each; and then, as the air is exhausted from the receiver, as one liquid

boils and another freezes, it will be found, that both thermometers stand at the same degree, and both gradually sink as the experiment goes on. This mode of performing the experiment serves also to prove the equal distribution of heat among objects near to one another; while it is equally decisive as to the effect of vaporization being promoted by removing the pressure of the atmosphere. If you think this worthy of insertion, the little trouble it has given me will be more than repaid by the pleasure of seeing myself in print, though I must remain Your servant,

ANONYMOUS.

The plate represents the air-pump with the ether and water. A is a phial of ether; B a glass vessel containing water; C C are thermometers, one being in the ether, the other in the water.

CHEMISTRY AS A SCIENCE.

Art. XXV.

LIGHT is the cause of colour, and very important effects result from bodies being exposed to, or excluded from its influence. Plants can be made to vegetate in the dark, but they remain white, are deficient in taste, and contain a less than usual proportion of *combustible* matter. This effect is well known to gardeners, who *bleach* several sorts of plants, by covering them with earthen pots, and thus excluding the light. It must be noted as a remarkable circumstance, that we also bleach vegetables by exposing them to the sun. In this case, however, the vegetable is *dead;* it is rooted from the ground, and, in general, is whitened by the united agencies of water and light. It is, therefore, the unknown principle of *life* in plants, by which the rays of the sun are thus modified in their effects.

The *living* vegetable acquires its intense green colour by exposure to the light, while the *dead* substance is whitened by such an exposure. The rays of the sun, then, only produce colour by acting on certain properties of different substances, and as these properties differ, so do the effects of light differ. If there were no light, there would be no colour; but it is plain, from the facts just stated, that light alone is not the cause of colour. What principle it is which thus makes bodies in general assume different colours, is not known. In the case of plants, however, the principle has received the comprehensive and significant name of life.

If the living vegetable, after being made to grow in darkness, be exposed to light, it becomes green, its taste is rendered more intense, and it acquires its usual proportion of combustible matter. This circumstance is looked on as a corroborative proof that light is the cause of colour in all bodies. Different bodies, it is supposed, absorb different rays, which thus *disappear*, and, reflecting only the others, appear of their colour. A red body, for example, is supposed to reflect the red rays of light, absorbing the others, while a green substance is supposed to reflect the green, and perhaps the blue and the yellow rays. A white body reflects all the rays, and a black body absorbs them all. We do not know that this is a correct explanation of the circumstance, for we do not recollect any experiments which have been made to prove, by exposing light reflected from different coloured bodies to the dividing action of the prism, that different coloured bodies do, in point of fact, only reflect certain rays. It seems liable to one palpable objection:—If *black* bodies absorb *all* the rays of light, it is difficult to explain how they are seen; on the other hand, white bodies cannot reflect *all* the rays undivided, or, according to the theory, they too would not be seen any more than light itself is seen. That there are difficulties about this subject, nobody who has thought of it denies; we merely hint at them, not to throw any doubts on the explanation as far as it goes, but to encourage in our readers that wholesome spirit of examining dogmatical explanations, which is the source of

all improvements in science. According to the above theory of colour, it is altogether a chemical phenomena. Light consists of different elements, and colour is occasioned by the different affinities possessed by other bodies for the different component parts of light. Colours, chemically speaking, are properties produced by the union of some ray or rays of light with particular bodies, from their having a greater or less affinity for them.

A very curious part of the phenomena of light is that which relates to pyrophori. Bodies, it is said, absorb light, and give it out unchanged: Mr. Canton calcined some oyster-shells in a good fire, and then pounded and sifted them: three parts of the powder were mixed with one part of the flowers of sulphur, and rammed into a crucible, which was kept red hot for about an hour. The brightest part of the mixture was then scraped off, and put into a phial well stopped. When this composition is exposed for a few seconds to the light, it becomes luminous, ceases to shine after some time, but again shines on being re-exposed to light. Heat, if applied to such a pyrophorus, increases the separation of light and shortens its duration. It has been indeed shown by Mr. Wilson, that the *blue* rays have a greater effect than others on many pyrophori, and that they cause an extrication of *red* light. The diamond, which gives out so much light, is a natural pyrophorus. Different kinds of meat, when beginning to putrify, fish, and various kinds of old trees, become luminous in the dark, and are therefore also natural pyrophori. The sea, under certain circumstances, appears all of a flame, the track of a ship is marked by a brilliant streak, and the water, as it dashes over her bows, seems ready to consume her. The slightest agitation of the waves, the ripple of the lightest breeze, the dash of an oar, stirs up a well of beautiful colour, most usually of a pale silvery whiteness, but sometimes of various and deep tints of green, or of red. The cause of this appearance of the ocean has not been distinctly ascertained; but it is generally supposed to be owing to numerous tribes of living beings floating in the water. The conclusion drawn from these facts is, that light enters into combination with different bodies, and that under certain circumstances it separates from them, producing changes in them, like the separation of any other element of their compound existence.

The curious phenomena of light, called polarization, is of modern discovery; and for a knowledge of it, we are indebted to the ingenious observations, first of M. Malus, and subsequently to those of Messrs. Arago and Biot, in France, and Dr. Brewster and Mr. Herschel, in Britain. From their experiments it results, that when two planes of polished glass, for example, are parallel to each other, light reflected from one is also reflected from the other; while, if they are perpendicular to each other, the light is not reflected from the second, but passes through it. Light penetrates through glass when in one position, but not in another; this peculiarity has been called polarization, and of late a great many facts have been noticed, which are occasioned or may be explained by this principle. The researches in which Dr. Brewster was engaged by this phenomena, led, we believe, to the invention, by him, of that amusing trifle, the Kaleidoscope; which, independent of the gratification of curiosity, and the pleasure derived from tracing the phenomena of nature, is, we believe, the greatest benefit which has been as yet derived to the world at large from the discovery of the polarization of light.

A question has been agitated by theoretical men, whether the light of the sun and of the stars, that of the moon, that produced by friction and by combustion, and that emitted by pyrophori, are the same: but the slightest attention to terms and facts would either have pre-

vented such a question being ever mooted, or would have led to the right solution. No *two* sensations of vision are identical or *one*, and therefore in this sense no two portions of light are the *same*. But certain effects of light, from whatever it may proceed, vision, for example, are *similar* though not *identical;* and as all correct classification proceeds on a principle of resemblance, the cause of these similar sensations is called one or the same, and *light* is therefore described to be the same substance, from whatever it proceeds. Another question mooted by theorists is, whether or not the sun is the origin of all light, and whether or not other bodies only shine by reflecting or giving out light derived from it. It has never yet been supposed, we believe, that the stars, which are themselves probably suns, derive their light from our luminary. There is, therefore, some other source of light than our sun: some cause why both they and it shine. As a knowledge of this is probably beyond the reach of our faculties, and we are not capable of ascertaining whether these orbs shine immediately from the will of God, or mediately by some intervening cause, such as the perpetual combustion of some ether or gas;* and as there seems no sort of proof that the light emitted in combustion has ever been derived from the sun, or may not, as well as its light and the light of the stars, be derived from some common source, it seems more philosophical to consider light as diffused among these different substances, and as elicited by some natural, and by various artificial causes. Of the former we know little, and are able to learn only little; yet, by means of the latter, some of the former may be explained.

The sources of light are, 1st, the sun and stars—of their luminousness no explanation can be given; 2d, heat; 3d, friction and percussion; 4th, phosphorescence; 5th, condensation and expansion; and, 6th, chemical action. When a piece of iron is put into the fire there is a certain temperature at which it becomes luminous; which is one of many examples of heat eliciting light. It is supposed that all bodies capable of enduring the requisite degree of heat, become luminous at about the same temperature. Perhaps the light occasioned by friction might, in some cases, be referred to the same cause, for that generally produces heat. But two pieces of quartz, when rubbed together under water, produce light, which, as the water must take off the caloric as it is produced, seems not to be elicited by the heat. Percussion is, however, a species of friction, and it is well known that flint and steel, when struck against each other, produce sparks. If this experiment be made over a sheet of white paper, a number of small black bodies are found on it, which, it has been proved, are small particles of iron driven off, and catching fire in their passage through the air. Of phosphorescence as a source of light we have already spoken, and it is a case in which bodies, under certain circumstances, emit light. We have an example of condensation producing light in the compression of oxygen, and if this be made in a glass syringe, a flash of light is visible: if a glass, filled with the same gas, be suddenly broke in vacuo, a flash of light is also perceived. We need scarcely quote an example of light being produced by chemical action; every species of combustion is such an example, and the great quantity of light then given out, is one of the circumstances which distinguishes this phenomena. In the example of light from percussion, the effect may be attributed to chemical action; there is no doubt also that the action of heat is accompanied by, if it does not produce, chemical action in the case of the red hot iron: in most cases of phosphorescence too, chemical action is going on; and thus the se-

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* See Mr. Arago's opinion recorded in The Chemist, vol. i. p. 304.

veral sources of light above enumerated may all be reduced to the single one, chemical action. At any rate, the facts we have stated do not admit of a doubt that light, both as cause and effect, is closely connected with a great number of chemical phenomena.

ON MAKING BEER FROM POTATOES.

M. Dubrunfaut has lately published, in the *Mem. de la Soc. Roy d'Agriculture*, an account of some experiments he has made on the fermentation of different substances. The following is worthy of our readers attention. "Wishing to ascertain exactly the action which is exercised on other vegetable matters in the state of fecula, when treated by maceration, he mixed 500 *grammes* of the fecula of potatoes with an equal weight of cold water; to which he gradually added 3500 more of boiling water; when the whole mass formed a very homogeneous paste, at the temperature of 50° of Réaumur, (124 Fahr.) In this state, he added to it 150 *grammes* of ground barley-malt, and stirred the whole well together for some minutes, in order to mix it thoroughly; he then left it at rest, in a stove heated to 50° of Réaumur. After some time, the mass, which was at first solid and thick, was completely liquefied, its taste changed, and it had become saccharine. On being submitted to the vinous fermentation, with a little ale-yeast previously added, it yielded on distillation, 38 *centimetres* of excellent brandy, at 19°. M. Dubrunfaut thus decidedly ascertained the property possessed by the malted-barley, of rendering the fecula fluid and saccharine in the space of an hour.

Still, with a view of applying these principles in rural economy, the author extended his researches to the more simple and least expensive methods of employing them; and, in the end, he effected the separation of the fecula of potatoes in a more convenient manner. The potatoes being rasped, or grated, very fine, 400 *grammes* of the pulp are thrown into a brewing-tub with a double bottom; and, whilst the workmen stir and agitate it with rakes as much as possible, boiling water is poured upon it; and all the fecula is then converted into a paste. 20 *kilogrammes* of finely ground malt are then added; and a small quantity of short wheaten straw may also be added with advantage. The whole becomes fluid and saccharine in the space of two hours.

The liquid is now drawn off, as in brewing, and conveyed to the fermenting-tub: the remaining mass of pulp is then left to drain for some time; when a fresh quantity of water, at 50° of Réaumur, is added, and the whole agitated as before. The liquor is then again drawn off, and the pulp submitted to the action of a cylindrical press. In this manner the greatest quantity of fermentable matter is extracted from the potatoes; the liquid is not accompanied with any kind of deposit injurious to the distillation; and 54 *litres* of brandy at 19°, of an excellent taste, may be drawn off from it. The residuum may be eaten by animals.

This experiment proves, that by means of this change in the process, the product of brandy is greater, and it possesses a more agreeable flavour, than when the potatoes are reduced to pulp by means of steam and agitation. The matter introduced into the alembic is perfectly fluid, and therefore presents no difficulty in distilling it; the manipulations are not more expensive, nor complicated; and they may be effected by the common apparatus, which is a very great advantage."

The following is what this gentleman says on converting the fermented potatoes into beer:—

"After having treated the fecula as before stated, he added hops to it, and concentrated the whole to 6° of the aerometer: he then submitted the liquor to fermentation, which, when terminated, a most agreeable and vinous odour exhaled from it: after some days, it was put into bottles, when it termi-

nated well, and greatly resembled the Paris beer.

"By fermenting the liquid without the addition of hops, and substituting the honey of Brittany in place of them, he obtained a beer which had the taste and all the qualities of the beer of Louvaine. But it is more particularly in the manufacturing of an economical beer, which is so useful to the numerous class of workmen employed in agriculture, that this invention is most valuable, for the potatoes and the barley used in this manufacture may be obtained every where; they are neither dear nor unwholesome; and it is not requisite to make a perfect beer of them, but merely to produce a light and refreshing drink, which neither requires boiling nor concentration. In order to do this, the liquid produced by the maceration may be diluted with a quantity of water, which may vary according to the alcoholic strength we wish to give to the liquor; and which may then be fermented with a little yeast, or even with baker's leaven."

QUERIES.

The cheapest method of staining glass a bright red, blue, green, and orange.

SULPHURIC ACID MANUFACTURE.

Newcastle, Sept. 13.

Sir,—I have read with some attention the article in No. XXI., which you call the English method, and also that in No. XXII., which you say is the French method of manufacturing sulphuric acid; and being myself a maker of the article, I feel interested in every thing that has the appearance of improvement in the manufacture, and shall therefore take the liberty of making a few observations on what you have published. In the first place, the method which you call the English, as described by Mr. Parkes, has been abandoned by English makers, many years ago; that essay, though very well in its day, can serve no possible purpose at the present time, but to mislead the ignorant, or to show the progress of improvement. It proves, however, (though Messrs. Clement and Desormes affirm the contrary) that the acidification *will* go on without any hole for the admission of atmospheric air, in the roof of the chamber. The method of operating in those times was this: for every 300 cubic feet capacity of the chamber, a pound of the mixture was inserted; supposing then the chamber clear, the first charge, by being burnt, would form some portion of incondensable gas; this, by the admission of atmospherical air at the doors, was driven to the top, and thus each charge lessened the capacity of the chamber, until, by Saturday night, the sulphur would scarcely inflame. On a moderate computation, not one-half of the sulphur was really used. The maker of course could never have made sulphuric acid by this method at the price it was usually sold at, but that the unconsumed sulphur, mixed with the sulphate of potash, was sold to the maker of roll sulphur, at a price near that of duty paid sulphur, 9-10ths of which duty the sulphuric acid maker had returned to him, he swallowing the Custom-house oath, that the "said sulphur was all consumed by him, in the making of oil of vitriol."

In the present plan pursued by English manufacturers, the sulphur and saltpetre are in different vessels, and both are in furnaces separate and distinct from the chamber; consequently, we have all the advantages of the French method, with this additional one, that we can burn sixteen charges in twenty-four hours. The principal difference seems to be this, that the French consider heat necessary, while the English prefer cold; so much so, that some makers have the roofs of their chambers covered with cold water, which they say promotes condensation. It is evident that in the manufacture of nitric and muriatic acids, *cold* is indispensably necessary: will then you, or any of your scientific correspondents, be so good as to in-

form us working people the cause of *heat* being preferred in this operation? Also, why is nitric acid used in preference to nitrate of potash, and what is the use of molasses in this process? You speak of a method called "with a continued current," which is unproductive in dry frosty weather—be so good as to describe this method. Are you aware that several English makers are working on a plan, (so far as condensation by steam goes,) precisely similar to the French method, while they substitute pyrites for sulphur? You may see the works of the patentee, Mr. Hill, at Bromley, in Kent, any day.

I have often read with attention the account given by Messrs. Clement and Desormes, of the *rationale* of the process, though I have never been a whit the wiser for it. They say, "the nitrous gas rises to the roof of the chamber, and there coming into contact with atmospheric air by means of a hole, and without which the manufacturers found the acidification would not go on," &c. Now, no such hole ever did exist in any chamber, unless it may be in those of these gentlemen; nay, if such a hole were made, no atmospheric air would enter; the pressure is altogether outwards, and if the smallest hole, even the size of a pin's head occurs, the gases issue out with great violence; in good sooth there is no occasion to make holes for such a purpose: any manufacturer, if his buildings be but of three years standing, will find plenty made to his hand. They add, "this contact with atmospheric air forms nitrous acid vapour, which, being a heavy body, immediately precipitates on the *sulphurous flames*. Now, though I am not chemist enough to understand the difference between nitrous gas, and nitrous acid vapour, I may be allowed to ask, how this nitrous acid vapour, be it what it may, can precipitate itself on the *sulphurous flame*, when that sulphurous flame is in a separate furnace, twenty yards from the chamber. But, above all, if this dancing up and down business, or, as they term it, "an alternate and frequent change into oxide and acid," be capable of acidifying a *great quantity* of sulphur, why should it not be capable of acidifying sulphur *ad infinitum?* Why should not one charge of saltpetre serve a chamber, as long as that chamber should last? I can see nothing in this "beautiful theory," as Dr. Ure calls it, to the contrary.

Of what do those uncondensed gases consist? They, "in damp weather particularly, fall all around, and destroy all vegetation in a pretty extensive circle." If they are uncondensible, they must be equally so in one method as well as in the other, and they seem to have a couple of wooden chimneys to one chamber for the purpose of carrying them off. I know that the gardens, within six yards of my manufactory, are as flourishing and productive as those six miles off; and my people, who live adjoining the manufactory, are as healthy as they could be in any other situation. As sulphur and saltpetre vary much in their respective qualities, what is the best test for mixing the proportion? or how do you know if you exceed in the use of either? and what is the effect upon the acid produced by an excess on either side? Information on any, or all of these points, will be acceptable to,

Sir,

Your most obedient Servant,

James Wright.

TRIPLE PLEASURE IN EATING.

It is obvious, when we consider the matter, that substances taken into the mouth may affect us in three modes. There is, first, the mere contact or the sensation of touch, all the parts of the mouth being endowed with this faculty, the tongue possessing it in an eminent degree; secondly, there is the sensation of taste; and thirdly, the sensation of smell, which is excited by some bodies. It is equally obvious, that every substance does not affect us in all these

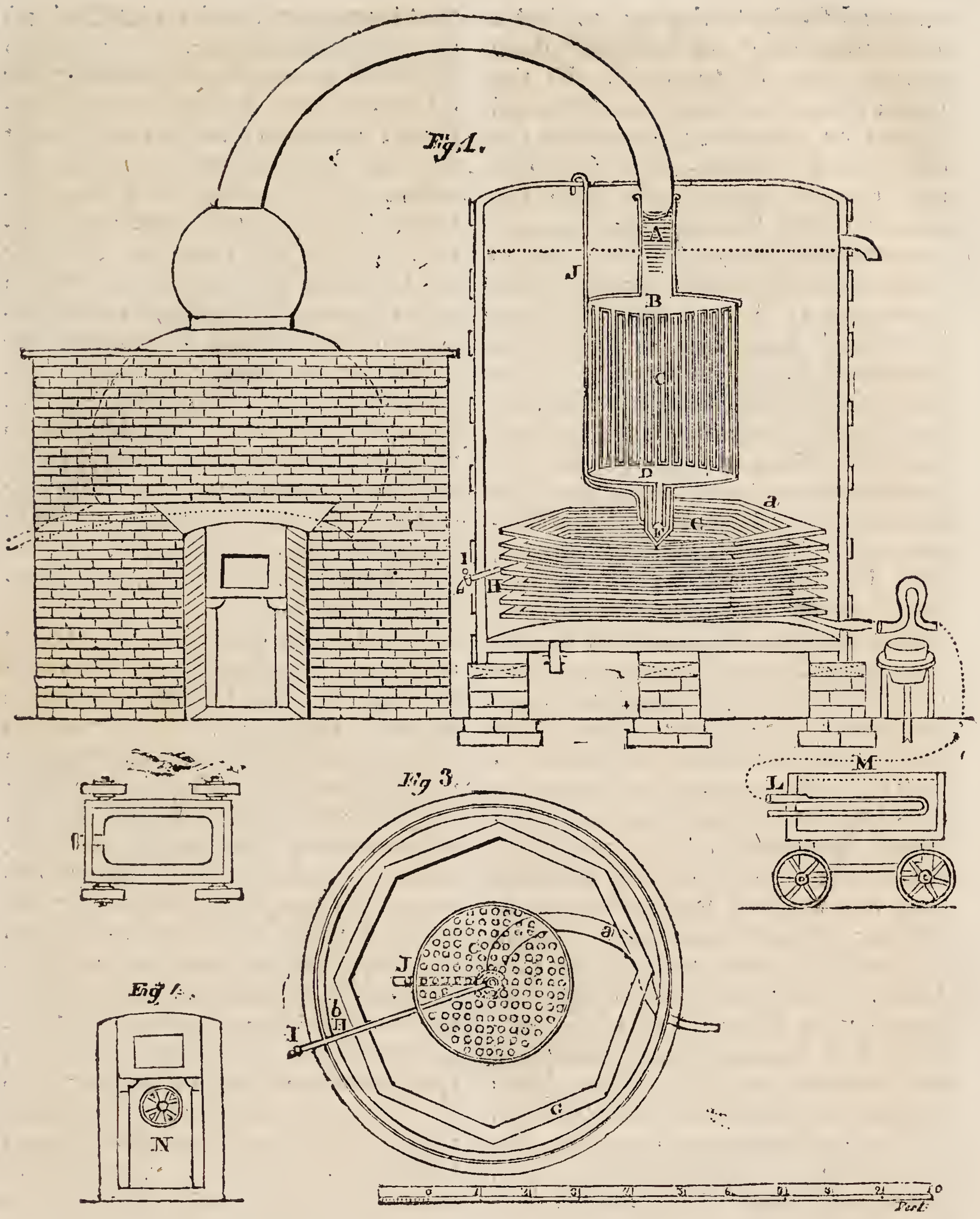
modes. Some affect only the sense of touch, as rock crystal, glass, ivory; some affect both the touch and the sense of smell, as certain metals. Brass, for example, on being put into the mouth, occasions the peculiar odour of that metal, while, if the nostrils are closed, only its hardness is perceived. Others again affect the taste and the touch. Sugar, for example, is felt both rough and sweet, and no difference is observed on closing the nostrils. A fourth class of bodies, such as the volatile oils, chocolate, and many other substances, affect the taste, the touch, and the smell. There seems no difficulty in distinguishing and separating the odour of a body from its other properties. It is only necessary to close the nostrils, and the sensation of smell is for the moment extinct. It is not so easy to distinguish between the other two sensations excited by a body. The method recommended by M. Chevreul is, to apply the substance to some other part of the body, and endeavouring to abstract that effect from the combined sensation felt in the mouth. Thus, he says, if chloride of calcium, reduced to powder, is applied to the skin, the perspiration is solidified, and a sensation of heat is perceived; if, on the contrary, hydrochlorate of lime, crystallized, and reduced to powder, be so applied, it liquifies, and a sensation of cold is experienced. On afterwards applying these substances to the mouth, the perception of heat occasioned by the one substance, and that of cold occasioned by the other, may be abstracted from the sensation of taste, only it must be remembered that the tongue is more sensible than other parts of the body. Thus we see, then, that in consuming our food there is a triple sensation, and if it be properly prepared, and slowly consumed, there may be a triple pleasure. The art of the cook, be it observed, is not perfect till all these sensations are the most pleasant which can be produced.

FRENCH AND ENGLISH GUNPOWDER.

By a report lately made to the Minister of War, in France, it appears that the best powder made in that country is composed as follows: In 100 parts 78.00 saltpetre, 12.88 charcoal, 9.12 sulphur. The best Dartford powder contains 79.70 saltpetre, 12.48 charcoal, 7.82 sulphur. A *litre* of the former weighs 905 grammes, while a *litre* of the latter only weighs 857. The difference of density is occasioned by being subjected, in the manufacture, to different degrees of pressure; and it is stated by the French chemists, that the more dense the powder, so as not to check the combustion, the better. The strength of the French powder of this density is considerably greater than English powder; but reduced to the same density, they are nearly equal. But the French powder with which these experiments were made, was the patent powder of M. Bouchet, and prior to his improvements, the best powder in France was 3-20ths less strong than that made in England. The comparison was made with Dartford powder; we believe, however, that a still stronger powder was, for a short time, made in England.

SPIRIT RECTIFIED BY MILK.

M. Cadet de Vaux states that, on rectifying spirit made of plums, which, before, was perfectly unsaleable, with milk, he purified it so much, that it passed with the best judges for excellent *kirsch wasser* (spirit made from cherries, and very much in request in Switzerland, Alsace, and other parts of the Continent). The instant the milk is put into the still it curdles, and, in that state combines with the volatile oil of the plum brandy. M. Cadet de Vaux draws as a conclusion, that the alcohol of all spirituous liquors is the same; and asserts that this discovery will be of some consequence to a large part of France, where plums are very abundant.—*Bulletin des Sciences Technologiques.*



DISTILLATION.

Art. V.

CONDENSING.

THE inventor of that method of distillation of which we gave in No. XXVIII. a description, from Chaptal, was a Frenchman, of the name of Edward Adam, an obscure and ignorant man,—as we are informed by a respectable correspondent, a countryman of his,—who by chance attended a lecture on chemistry at Nismes, about the year 1800, and there saw a Woolfe's apparatus. He immediately conceived the idea of applying this to the distillation of brandy, thus employing all the heat carried off by the vapours in vaporizing other alcohol, and obtaining by one single operation spirit of any degree of strength. About the same time that Adam first employed a Woolfe's apparatus for distillation, another Frenchman, of the name of Berard, invented a different means of accomplishing nearly the same object, but in a more simple manner. Berard was a distiller at Grand Gallargues, in the department of Gard, and his patent was for an improved still. He applied a high head and rather long neck to the body of a common still, which was

exposed freely to the air, so that a condensation of vapours took place in the head of the still. In the upper part of the still Berard placed ledges or partitions, on which the condensed vapours fell, and did not return immediately into the still, so that the vapours, as they successively arose, had to traverse a layer of condensed liquid. The processes of Berard and of Adam have both been since very much improved by M. Menard, M. Cellier-Blumenthal, M. Derosne, and M. Alegre. At present, the method generally followed in France, is called *continued distillation*, and was first suggested by M. Cellier-Blumenthal. The principle of this is, that the operation never stops. Wine, or the liquor to be distilled, enters at one end or side of the apparatus, from a reservoir or other means of supply; the portion which first rises in vapour passes into other wash or wine, vaporizing a portion of it, and the spirit issues at the other extremity of the apparatus, completely fit for use. By this system, spirit of any strength may be obtained by the same operation: it is only necessary to take it from a different part of the machine. The wine, which is afterwards also to be distilled, is employed as the means of condensing the vapours, so that not a single portion of caloric is wasted. M. Cellier's apparatus was, we believe, like that of Woolfe's, on a horizontal plan; that of M. Derosne and M. Alegre is, we are informed, so constructed, that the vapours ascend, and are condensed in their progress upwards. It is beyond our limits and our means to describe all the mechanical contrivances by which the principle of making the vapours from the boiling wine vaporize the spirit of the wine not directly exposed to the action of fire, and by which the wine to be afterwards distilled is made the means of condensing the vapours, thus taking all that caloric carried off by the condensing water in the ordinary methods; all we can do is to record the chemical principle, and express our wish that it may be acted on in England as well as in France. In a future Number we shall give some further details on the expense of the different methods, which we are at present obliged to suspend, in order to have room for a description of a new condensing apparatus. A Mr. Williams, of the city of London, merchant, has taken out a patent for an improved condensing apparatus, to answer the following purposes:—First, to improve the quality of the spirits. Secondly, to enlarge and accelerate the condensation. Thirdly, to prevent accidents from the bursting of the still. And lastly, to increase the quantity of the spirit. These purposes he effects by the following means:—

Fig. 1 is an elevation, and Fig. 2 a plan of the apparatus; the same letters referring to the same parts in both figures: the still-head is made spherical, immediately above the ring which lutes into the still; and from the upper part of it rises a circular crane-necked pipe, which, after reaching the necessary degree of elevation, as hereafter described, turns down and lutes into the neck of the condenser. This condenser, which is to be placed in the centre of the condensing tub, consists of A, fig. 1, the neck which conveys the steam or vapour into B, the upper drum; whence it is divided amongst a number of small vertical pipes C, figs. 1 and 3, which should never be made to exceed three quarters of an inch in their interior diameter. The condensation takes place, in part, in the upper drum, and is fully completed in these pipes or tubes, from whence the condensed fluid passes into the lower drum D, fig. 1, and through E, its neck, into F, a box or trap inclosing the said neck E, from the upper part of which trap F it enters the cooling-worm G. It is evident that the box or trap F is in working always partially full of liquid, and the neck E being immersed therein, any steam or vapour which may have escaped condensation can pass no farther. The box or trap F has a funnel-like

bottom, from which a pipe H passes, with a considerable descent between any two of the coils, turns, or bouts of the worm, and through the side of the worm-tub, where it is furnished with a cock I. The use of this pipe is to draw off any foul or impure spirit, which may rise in the first stage of the process; and to discharge what may remain in the box or trap F when the process is over. To this box or trap F is also attached another pipe J, figs. 1 and 3, which is called the air or safety-pipe, and its purpose is for the egress and ingress of the atmospheric air from and to the condenser, to prevent both pressure and a vacuum therein. The flat octangular cooling-worm G, after making six complete turns or bouts in the worm-tub, assumes a circular shape, where it diverges off to pass through the side of the tub; and to its end or mouth, outside the tub, which is made a little tapering, is fitted, and is to be occasionally applied, a crane-necked pipe K, fig. 1, of the same area throughout as the end of the worm, and which pipe K may be elevated or depressed at pleasure, sufficiently high, when upright, to keep three or more coils of the worm full of spirits. This is intended to be applied in hot weather, or in hot climates, to cool the spirits more effectually, by subjecting the same in a greater degree to the effect of the cold liquor (water) in the worm-tub, acting upon the whole surface of the coils of the worm so kept full, and thereby assisting to prevent the evaporation of the spirits. But in hot climates a further additional apparatus is recommended, the invention of which is also hereby claimed the more effectually to obtain this end. This additional apparatus consists of another pipe L, into which the discharging end of the crane-necked pipe K is made to enter, and which pipe L, after passing through the end of the trough M, is made of a broad flat shape, and running the whole length of the trough, returns gently, declining in its whole course; and, becoming again of a circular shape, passes again through the end of the trough M at which it entered, and discharges itself into the wide mouth or funnel of the pipe which conveys the spirit into the receiver. This trough M, which may be made of any required dimensions, is to be filled with Glauber's salts and nitre, or any other chemical preparation or composition capable of producing cold, the more effectually to cool the spirit. In order the more easily to introduce such chemical preparation under and between the two flat folds or leaves of the said pipe L, through which the spirit passes, one side of the trough M may be made to open, either by sliding in grooves or turning upon hinges; and the trough may be placed upon a carriage with wheels, the more easily to be brought to and conveyed from its requisite situation when used; or it may be placed there upon tressels or other proper supports of the requisite height. The little figure marked N represents a register adapted to the ash-pit of the furnace, but seems of no importance.

We do not know in what degree the patentee, who, by the by, is not the inventor, he having received the invention from some foreigners, thinks this contrivance will be useful; but, for our parts, we do not see that it will be of great value. We are sure, indeed, that it can never make the ordinary methods of distilling so advantageous as the continued method of M. Desrone and Alegre; but while the state of the law is such, that this cannot be carried into practice, Mr. Williams's may be useful. It may certainly be a security against *blowing*, but it adds much to the complexity of the condensing apparatus.

DR. JENNER ON THE MIGRATION OF BIRDS.

From the Philosophical Transactions for 1824, *Part I. recently published.*

It is not my intention, in the following pages, to give a general history of the migration of birds.

The order in which they appear and disappear, their respective habits, and many other observations, have been given with considerable accuracy by several naturalists who have paid attention to this very curious subject. It is with a view of representing some facts, hitherto unnoticed, chiefly with respect to the *cause*, which excites the bird, at certain seasons of the year, to quit one country for another, that I communicate the following pages to this learned body.

But before I proceed to state my observations on this head, it may be necessary to adduce some arguments first, in support of the reality of migration, the fact itself not being generally admitted; and secondly, against the hypothesis of a state of torpor, or what has been called the hibernating system.

In the first place, the ability of birds to take immensely long flights is proved by the observations of almost every person conversant with the seas. To the many instances already recorded, I shall add the following:—

My late nephew, Lieutenant Jenner, on his passage to Newfoundland, saw on the 20th of May the hobby hawk. It came on board, and was secured. The day following a swallow came on board. At this time the ship was steering a course direct for that island, and was not within the distance of an hundred leagues of any land. His brother, the Rev. G. C. Jenner, in crossing the Atlantic, observed an owl (of what species he could not precisely ascertain, but he believes it to be the common brown owl) gliding over the ocean with as much apparent ease as if it had been seeking for a mouse among its native fields.* Wild geese have frequently been shot in Newfoundland, whose crops were plentifully stored with maize or Indian corn; consequently, these birds must have taken a pretty bold flight in a short space of time, as no corn of this kind is cultivated within a vast distance of that island. These, however, I do not consider as migrations of any further consequence than just to show the powers of the wing.

My ingenious friend and neighbour, the late Reverend Nathaniel Thornbury, who had occasionally visited Holland, informed me that the pigeons about the Hague make a daily marauding excursion, at certain seasons, to the opposite shore of Norfolk, to feed on vetches, a distance of forty leagues. Now, may not this be almost considered as daring a flight as that of the bird which crosses the Atlantic? For it is not at all probable that the shores of this country can be visible to the flock when they set out.

Again: Is there not something as extraordinary in the pigeon, which can in a few hours find out its home, though taken away in a box and totally excluded from the light, to the distance of two hundred miles, as in that bird which quits one shore to seek another, whatever may be the extent of intervening seas? The fact seems to be, that we, the *little lords of the creation*, are too prone to measure the sentient principle in animals by the scale of our own ideas, and thus, unwillingly, allow them to possess faculties which may surpass our own, though peculiarly appropriate to their respective natures; but a little reflection must compel us to confess, that they are endowed with discriminating powers totally unknown to, and for ever unattainable by man. I have no objection to admit the possibility that birds may be overtaken by the cold of winter, and thus be thrown into the situation of other animals which remain torpid at that season; though I must own I never witnessed the fact, nor could I ever obtain evidence on the subject that was to me satis-

* Mr. Jenner informs me, that in subsequent voyages, he has taken in the Atlantic, several hundred miles from land, the nuthatch, hoopoe, and snipe; and has often seen small birds of the linnet kind. Of the latter, a large flock came on board, perched on the rigging, appeared very lively, and after adjusting their plumage, and chirping in concert for a few minutes, took their flight in a direction for the Azores.

factory; but as it has been often asserted, may I be allowed to suppose, that some deception might have been practised with the design of misleading those to whom it might seem to have appeared obvious? For far be it for me to insinuate that the subject has been wilfully misrepresented by those naturalists who have stated it as a fact. Yet how careful should we be in the investigation of all subjects in natural history which may captivate by their apparent novelty!

If birds crept into holes and crevices to hibernate, would they not, like quadrupeds, creep out again in a languid state, their fat all absorbed, and their bodies emaciated? We see this fact exemplified in the hedgehog, one of the most remarkable of our hibernating animals, which retires to its hut at the approach of winter, with vast stores of fat placed in every situation where nature could find room for it. This fat is its only source of nutrition for the winter, which, by the time the sun rouses it to fresh life and activity, is exhausted, and the animal comes forth thin and emaciated. But the case with birds is extremely different. If, on the first day of its appearance, a martin, a swift, or a redstart be examined, it will be found as plump and fleshy as at any season during its stay; it appears also as strong on the wing, and as full of activity at that period as at any other during its abode with us. How the cuckoo, that disappears at so early and so hot a season as the first week in July, can become torpid, is beyond the power of conception.

The apparent incapability of the landrail to perform the task of migration, has often been so strongly adduced as a presumptive argument in favour of the hibernating system, that those who do not admit that of migration, were it to remain unnoticed, might urge it as an objection. It must be admitted, that a superficial examination of the habits of this bird tends to favour the supposition of its incapacity for so great an exploit, as it often rises from the ground like an half-animated lump, and seems with difficulty to take a flight of a hundred yards; but let us remark its powers when seriously alarmed. Should it be forced upon the wing by any extraordinary cause, by the pursuit of a hawk, for example, the velocity of its flight, and the rapidity of its evolutions to avoid the common enemy of its race, will at once appear. This is no very rare exhibition. Necessity here, as in migration, becomes the parent of exertion, which, when thus called forth, cannot be shown in a much greater degree by any of the feathered tribe. The moor-hen (which winters with us) gives another instance of what a bird, which appears so much to want activity in its ordinary flights, is capable of performing when exertion is actually required. When pursued by a hawk, and self-preservation calls up all its powers, it may be seen to rush up into the air with amazing velocity, almost as high as the eye can reach, then darting down with an equal pace, it often, by such rapid manœuvres, escapes the destructive talons of its swift pursuer.

It is a remarkable fact, that the swallow tribe, and probably many other birds which absent themselves at stated periods, should return annually to the same spot to build their nests. The swift, which for nine months has some distant region to roam in, was selected for the purpose of an experiment to ascertain this with precision. At a farm-house in this neighbourhood I procured several swifts, and by taking off two claws from the foot of twelve, I fixed upon them an indelible mark. The year following their nesting places were examined in an evening when they had retired to roost, and there I found several of the marked birds. The second and third year a similar search was made, and did not fail to produce some of those which were marked. I now ceased to make an annual search; but at the expiration of seven years, a

cat was seen to bring a bird into the farmer's kitchen, and this also proved to be one of those marked for the experiment.

(To be continued.)

FORMATION OF IODOUS ACID.

CHEMISTS have long been acquainted with *iodic* acid; and the honour of discovering it seems to belong equally to Sir H. Davy and M. Gay Lussac. M. Somertini, of Naples, supposing that *iodous* acid might also be formed, made some experiments on the subject, and succeeded. By mixing equal parts of iodine and chlorate of potash, a yellow mass is obtained; if the iodine is in excess the colour is grey, and a peculiar effect is observed. This is put in a retort, the neck of which is to be carefully cleaned, and to it a tubulated balloon, to which is added a curved tube to condense the gases, is adapted. The retort is to be heated at a spirit lamp; at first the violet-coloured vapours of iodine arise, which soon disappear by the action of the oxygen, and a yellow vapour appears, which condenses in the neck of the retort into a yellow heavy liquid, a part of which runs even into the balloon; at the same time oxygen gas is disengaged. The yellow fluid is iodous acid; its taste is acid and astringent, and it leaves on the tongue a sensation of heat which lasts a long time. It is of an oily consistence, and adheres to the sides of the vessel; it is heavier than water, and smells like oxide of chlorine; it is very soluble in water and alcohol, to which it imparts its own colour. It evaporates slowly in the air, at a temperature of 122 Fahr. and is easily volatilized. Mixed with sulphur and heated, it is decomposed; violet vapours arise, but without any detonation. Carbon has no action on it, but liquid sulphurous acid decomposes it. The instant potassium is brought into contact with this acid it catches fire, and burns with white flames and dense vapours, but without any very perceptible disengagement of iodine. Phosphorus, also, when brought into contact with it, burns like red hot iron, with a species of detonation, and, at the same time, iodine in vapours arises. These two last effects are regarded by M. Somertini as distinguishing characteristics of this acid.—*Giornale di Chimica.*

DICTIONARY OF CHEMISTRY.

CEYLONITE. A dark blue coloured mineral, which comes from Ceylon.

CHABASITE. A mineral found in Germany, composed of silica, lime, alumina, soda, potash, and water.

CHALK, in chemistry, is carbonate of lime; it is mixed with a small portion of clay and silica: some specimens contain a little iron.

——, BLACK. A mineral substance, used in drawing; both it and *red chalk*, which owes its colour to oxide of iron, are *clays*, or consist chiefly of alumina, while *silvery chalk*, as well as common chalk, are carbonates of lime. It is one example of the injudicious extension of a common name, the term "chalk" being in these cases applied to substances which are chemically different.

——, SPANISH. The *soap rock.*

—— STONES. Concretions which are formed in gout have been so called. They were first described by Dr. Wollaston.

CHALYBEATE. Waters impregnated with iron are so called, and thus the name has been extended to other things.

CHARACTERS, CHEMICAL. A set of marks invented by the alchymists to distinguish chemical substances, and give an air of mystery to the science. As such things are, however, convenient abbreviations in writing the names of substances which often occur, modern chemists have invented a systematic set of characters to apply to every substance. They have never come into general use.

CHARCOAL is a black, shining matter, which remains when vegetable substances are subjected to distillation. It may be procured from all vegetable substances, but

is usually obtained on a large scale by building layers of wood into a pyramidal form, covering the pile with clay or earth or ashes, leaving a few air-holes, which are closed whenever the mass is well ignited. Great care is taken in preparing charcoal for various purposes, such as making gunpowder, &c. When made on the large scale, it appears from some experiments of Mr. Muchet, that the quantity obtained depends both on the texture of the wood and the mode of managing it. Made in the small way, it depends on the quantity of carbon contained in the wood. Different species of wood are found to contain different quantities of carbon. Thus, 100 parts oak contain 22.682 charcoal; mahogany, 25.492; lignum vitæ, 26.857; Scotch pine 16.456; Norway pine, 19.204. A good charcoal has been obtained from turf; and animals also yield carbon.

Chay, or Chaya Root. The root of *oldenlandia umbellata*, which grows wild on the coast of Coromandel, and is used by the natives of Hindostan as madder is used in our country, and gives the beautiful red so much admired in Madras cottons.

Cheese can be obtained from milk by adding to it any mineral or vegetable acid, whence it is concluded that it exists ready formed in the milk. Its goodness, however, depends in a great measure on the quantity of cream, or oily matter of the milk, with which it is combined. Curd, which is the principal part of cheese, very much resembles albumen. Good cheese melts at a moderate heat: bad cheese dries, curls, and cracks like horn. An acid called the caseic has been found in cheese.

Chemistry may be defined, The science which treats of all the changes which take place in the material world, unaccompanied by perceptible motion, including, as one of its objects, to investigate the composition of all material substances.

Chenopodium Olidium. A plant in which MM. Chevalier and Lassaigne have detected uncombined ammonia, making it smell like putrid fish.

Chiastolite. A mineral found in Britain, Spain, and France, which is rather remarkable for its crystals.

TO MAKE GINGER BEER.

The following receipt has been handed to us, we believe, by one of our former Correspondents, who took on themselves the humble appellation of "Dairy-maid." It was not, however, authenticated by a signature; but the specimen sent us of the drink has satisfied us of the goodness of the receipt. Take three-quarters of an ounce of pounded ginger, half an ounce of cream of tartar, and one pound of lump sugar, (if any person does not like it very sweet, a less quantity of sugar may be used) and five quarts of water; boil the ginger in the water about half an hour, and then pour the whole on the sugar and cream of tartar. When nearly cold, put a table-spoonful of the best yeast on a piece of toasted bread, and add it to the mixture. When it has worked about twelve hours, or somewhat longer in cold weather, bottle it in stone bottles, and be careful to tie or wire down the corks, or they will fly out. In about three or four days it will be fit to drink, and will form a pleasant, refreshing summer beverage.

DISEASED VISION.

To the Editor of the Chemist.

Sept. 12.

Sir,—I am a constant purchaser of your publication, and on looking over No. V. of The Chemist I saw a case of Dr. Wollaston, who it appears was affected by a partial blindness, as is described in an article, page 78. I was myself affected in a manner exactly similar, the attacks recurring generally as often as once a fortnight, but never was I free from them a month together. At present they are not so frequent as formerly, but I am not altogether free from them. I am naturally of a nervous

habit, and most of my medical friends consider these symptoms to arise from a nervous debility of the organs of vision, or of the system generally. I experience precisely the same symptoms Dr. Wollaston describes; they are generally succeeded by excessive head-ache and debility.

I shall feel much obliged by your insertion of this, as perhaps it may lead some of your readers to trace the real cause of the complaint, and find a remedy to relieve me and others of my fellow-sufferers, who peruse your work, from their distressing situation.

I am, Mr. Editor,

Yours,

G. S. W.

NEW PURPLE DYE.

M. Bussy,* whose name has before appeared in our journal, has lately made some experiments on the sulphuric acid of Nordhausen, and among other results obtained the following curious one:—"Among all the properties of the fuming liquor, (the fuming sulphuric acid of Nordhausen,) it is remarkable that it dissolves indigo instantly even when cold; but this solution, instead of being blue, like the ordinary solutions of indigo in sulphuric acid, is of a magnificent purple, resembling precisely the vapour of indigo. Fearing," he adds, "that this colour arose from some extraneous matters, I purified a portion of the indigo by sublimation, and the same phenomenon was renewed. This property of dissolving indigo purple, is inherent in the pure sulphuric acid, and the sulphurous acid does not at all contribute to it. When the solution is exposed to the air, the acid attracts moisture, and the solution becomes blue. The same effect takes place if common sulphuric acid be added. I consider," says M. Bussy, "that in the purple solution, the indigo is much more divided than in the blue, and that the purple colour, which is proper to it, appears for the same reason as indigo; though blue, when in mass, becomes red when dissipated by heat into vapour." The fuming acid, from dissolving a much larger quantity of indigo, proportionally, than the ordinary acid, would, according to M. Bussy, be of great value in the arts, could it be cheaply manufactured.

* Vide Chemist, vol. i. p. 262.

TO CORRESPONDENTS.

We cordially accept the congratulations of our old friend "A Chemist." The price of the article he inquires about is, we understand, 6s. each, and if we hear of any thing better, we will inform him.

An application has been made to us for a person who will undertake to put up and manage a mustard mill, on a small scale, in the country. Any of our Correspondents or readers who may wish to learn further particulars, must apply by letters, post paid, to us.

J. Smith should send us a more precise address, as we doubt, with his present address, if a letter would find him.

Guarus should perhaps rather seek the opinion of a physician than of a Chemist. The proportion of *nourishment* which man can extract from different substances is not, we believe, ascertained, and seems to depend on the nature and occupations of the animal. The Irish subsist almost entirely on potatoes, and the Hindoos on rice. The elementary difference between vegetable and animal food is, that the former, as the rule, contains no *azote*, while the latter does, though there are many exceptions to this. It results from the experiments of M. Magendie, that animals connot long subsist on substances wholly destitute of azote. Unless we were informed, however, of every portion of food taken by our Correspondent's friend, it would be impossible for us to say whether it contained any of this principle or not: with this exception, we know no reason why life, and health, and vigour should not be as well preserved by a judicious vegetable as by an animal diet.

H. M. C. has been received.

We do not think it necessary to insert the correction sent by Mr. Brown, as the words he wishes to be added will not make the circumstance, of the combustion taking place in an open cylinder, plainer than it has already been stated in The Chemist.

*** Communications (post paid) to be addressed to the Editor at the Publishers'.

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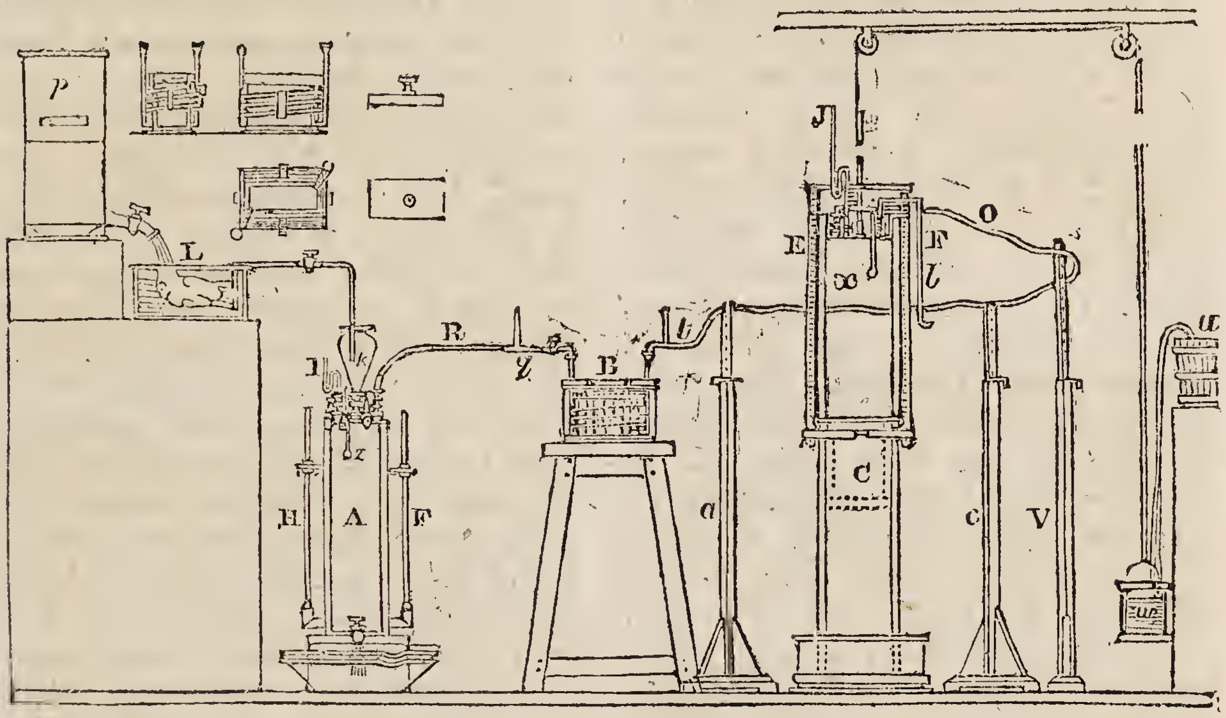

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M. DESPRETZ ON ANIMAL HEAT.

We mentioned in our first Volume, in the Article on Respiration and Animal Heat, page 331, the experiments of M. Despretz on the latter branch of the subject; and we have now the pleasure to lay a more detailed account of them before our readers, accompanied by a plate of the apparatus, best adapted, in his opinion, for making these experiments. "Every apparatus," he says, "for measuring animal heat ought to be composed of three principal parts,— a gasometer to supply the animal with air, a box to contain the animal, and a second gasometer to receive the gas respired. These three parts are indicated in the figure by the letters A B C. A, the reservoir for air, is a gasometer carefully graduated. By means of the lateral tubes, H F, the level of the water in the interior, and consequently the volume of the gas, is known. A thermometer, Z, shows

its temperature; the manometer, I, gives its elasticity; K is a funnel placed above the gasometer, and kept constantly full of water by communicating with a tub, L, which receives water from a large reservoir, *p*. When it is wished to make the gas issue, the cock, K, is opened, and the weight of the falling water forces the gas along the tube, R, and its motion is always of the same velocity as long as the water falls. An equal velocity may be always produced by means of an index adapted to the cock, which would enable the operator to turn it to the exact same point. The thermometer, *q*, gives the temperature of the air at its entrance into the box. The thermometer, *t*, shows its temperature on leaving the box. The air is then received in the gasometer, C, which consists of a large cylinder of cast metal, about one foot in diameter, in the interior of which a wooden cylinder, about eight inches in diameter, is fixed, and the interval between the two is filled with mercury. The cylinder has a cover of the same metal. The wooden cylinder is enveloped by a hollow copper cylinder, which is painted and moveable, and is plunged into the mercury; but as the respired gas reaches its interior, it is raised up by the counterweight, ω, which is a pail, that is gradually filled by means of another, *u*, full of water, with which the first communicates by a straight syphon.

By means of the measures, F E, divided into equal parts, the volume of the gas may be known. In consequence of the flexibility of the leaden tube, *t o*, the copper cylinder can be elevated without injuring any part of the apparatus. The manometer, J, shows if the the interior and exterior pressure are the same. When all the gas of the reservoir, A, is forced out, the volume of the gas respired is exactly measured, and its temperature ascertained by the thermometer, *x*. All the cocks are then closed, and by means of a greater or less degree of pressure on the copper cylinder, the gas is forced out of the tube, L, and is received on the mercury in a porcelain vessel. *a*, C, and V, represent the wooden supports for the leaden tube, as the copper cylinder rises in the reservoir.

The animal is placed in the copper box, B, which must be sufficiently large not to incommode it; this box is provided with a large rim, which receives a cover, and the space betwixt the box and the cover is filled with mercury. The small box containing the animal is placed in a copper chest, and the weight of all the copper, as well as of the water employed, is known. The whole apparatus is placed on wooden supports, which are very dry, and the animal is kept from coming into contact with the copper, by the box being lined with ozier twigs. The air furnished by the gasometer passes at first into the box, in order that it may be found, when the temperature of the water is observed, in the same state as at the end of the experiment. The temperature of the water is ascertained with great precision. During the whole time of one experiment, which in general lasts two hours, the animal receives a constant and steady supply of air. The gas which has been respired contains, in general, 6 per cent. carbonic acid; and the quantity is ascertained by treating it with potash: the air, after being separated from the carbonic acid, is analyzed by hydrogen gas.

M. Despretz then details a number of experiments which he made on various animals, from which, he says, it results, that respiration produces a less proportionate quantity of the whole animal heat in carnivorous animals than those that are frugivorous; the same circumstance holds good of birds, as compared to mammiferous animals. He considers it as incontestibly proved: 1st, That respiration is the principal cause of the developement of animal heat, assimilation the motion of the blood, the friction of the different parts produce the

remainder. 2dly, Besides the quantity of oxygen which forms carbonic acid, another quantity, very often considerable compared with the former, also disappears; in general, it is thought to be employed in the combustion of the hydrogen of the blood. More oxygen disappears in the respiration of young animals than in that of adults. 3dly, There is an exhalation of azote in the respiration of mammiferous, whether carnivorous or frugivorous, and also in the respiration of birds. The quantity of azote exhaled is greater with frugivorous than in carnivorous animals. In no one case, of more than 200 experiments, did respiration produce less than 7-10ths, or more than 9-10ths of the whole heat emitted by the animal; and, in fact, the proportion of 7-10ths was only observed in very young animals, which sometimes lose a portion of the heat proper to them. M. Despretz has not yet concluded his researches; and when any further portion of them, possessed of any interest, is published, we shall lay it before our readers. To some of them it may be interesting to see the following table of the temperature of different animals; that of the air was 60° Fahrenheit:—

	Mean Temperature.
Nine men, aged 30	99.0° Fahr.
Four do. 68	99.0
Four do. 18	98.5
Three boys from 1 to 2 days old	95.0
Two full grown crows	109.1
Four screech-owls able to fly	105.6
One full grown do	107.0
Three pigeons	109.2
Three sparrows, fledged	103.7
One sparrow, full grown	107.0
One do. old	107.5
One yellowhammer	109.2
Two rooks, just beginning to feed alone	106.0
Puppy, three months old	103.0
Tom cat, an adult	103.5
Guinea-pig	96.4
Two carp	53.0
Two tench	53.0
Water, in which the fish lived	51.5

LECTURES ON CHEMISTRY AT THE ROYAL INSTITUTION.

On Tuesday, October 5th, Mr. W.T. Brande, F.R.S., &c. &c., Professor of Chemistry in the Royal Institution, &c. &c., began delivering, at the Rooms of the Institution, Albemarle-street, his winter course of Lectures on Chemistry. In the first lecture the professor only sketched the outline of the manner in which he meant to treat the science, and therefore it consisted rather of a dry, logical arrangement than of any interesting details. That outline, however, we shall give, that such of our readers as attend these lectures may have an assistant to their memory, and that such of them as do not, may know how science is studied at the West End, and in Societies under the patronage of royalty.

The object, the professor began, of the course of lectures he was then commencing, was to explain the principles and practice of chemical science as it at present exists, and he meant not to enter into the history of the science, or into any description of those theories which had too much occupied the attention of chemists. These were proper and laudable subjects for private study, and his course should rather be directed to the explanation of such chemical phenomena as could not be so well studied in private, from their requiring to be elucidated by experiments. The more special object of the first lecture was to point out to the students' attention the books and authorities they might consult if they wished to get acquainted with the history of chemistry, to enumerate the substances which would be brought before them, and point out the method in which he proposed to study them.

Chemistry was obscure in its origin, though some men, fond of tracing it up to antiquity, had discovered that Tubal Cain, from working in metals, and Noah, from having made wine, were acquainted with chemistry. But they only *practised chemical arts*, and had no knowledge of chemistry, properly so called, or what was now understood as *constituting the science*. The alchymists were a set of men who had for their object to discover

the transmutation of all metals into gold, and to find out an universal elixir. Vain as their pursuits had appeared to some persons, they were founded on, to them, an apparently reasonable view, and on extensive and deep researches. They had formed several valuable metals from the useless ores, and had transmuted several substances into useful metals. From the ore of lead, for example, they had extracted a malleable metal; they had brought to light properties which it did not before seem to possess; and hence they were led by analogy to believe they might work still further changes, and transmute all the baser metals into the nobler and more valuable ones of gold and silver. Neither were their views so visionary as to a universal medicine as some people had supposed. They had detected in several substances many useful medical properties, and hence they were led to believe more extensive researches might enable them to add to the span of life, and some even supposed they might discover the means of conferring immortality on the body. Such speculations were now of no importance; but he would mention, for those who chose to examine into the subject, the names of such authors as they might best consult. The first was Elias Ashmole,* and his principal work was entitled *Theatrum Chemicum Britannicum*. The writings of Salmon would also afford information. In 1560 he edited Flammen's System of Alchymy. Roger Bacon, who flourished about 1240, was also an alchymist. His *Opus Magus*, edited by Dr. Jebb, was worthy of attention. Indeed, all these works abound in documents connected with the history of the science. Albertus Magnus, a native of Cologne, seems to have been directed by a philosophical spirit of investigation. Raymond, Lully, and Arnold of Villanova, had published voluminous essays on chemical subjects. George Ripley's Marrow of Alchymy was also an authority. Alchymy came afterwards to be connected with astrology, and even two writers were found who cultivated this connexion so late as the latter half of the last century. One of them was Dr. Price,* the author of a History of Cornwall; the other was Woolfe, who had an extensive acquaintance with chemical science, and is the author of several good papers in the Philosophical Transactions. There was another class of experimenters, of whom Basil Valentine † was one of

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* This gentleman, who styled himself *Mercuriophilus Anglicus*, published and edited many works on alchymy. He has also a higher claim on the gratitude of students, as the founder of the Ashmolean Museum, at Oxford, in 1679.—Ed.

* Dr. Price,—lest any of our readers should confound him with another Dr. Price, who was so celebrated about the time of the American war,—we think it right to add, was a physician, and a member of the Royal Society. In 1784, he publicly proclaimed that he could make gold, and had made it in the presence of several persons; he even presented some of it to the King. The Royal Society, however, empowered the celebrated chemist, Mr. Kirwan, and the alchymist, Woolfe, to examine into the pretensions of the Doctor; and he was obliged to submit to the trial. He first of all excused himself by saying, he had employed all the powder in the first attempt; but was compelled by reproaches to begin the task. In this state his art forsook him; with anxiety he endeavoured to convert mercury, by means of phosphoric acid, into silver; he performed experiments, which consisted in treating arsenic with volatile alkali, and what is called the Constantine experiment. All failed; and he was called on to make some more of his powder. After an uninterrupted labour of six weeks, he made his will, distilled for himself a pint of laurel water, drank it, and died in half an hour, at the age of 26, a martyr to a delusion, that, even were it realized, would have no value, nor be of any utility. He was a man of great talents, but of greater ambition, and aimed at the reputation of the greatest genius of the age. He was possessed of considerable property, but wrecked his happiness and lost his life, by being so credulous as to believe the assertions of the alchymists.—Ed.

† The name of Basil Valentine, who was a Benedictine monk, seems to have been his appellation as an author, and assumed by him out of vanity or ostentation. Basil, or rather the Greek word from which it is derived, signifies gold or king, while *Valentine* signifies

the leaders. His book, which was published in 1674, was intended to write down the followers of Galen. Paracelsus came after him, and he connected chemistry with medicine. To him belongs the merit of having introduced mercurial medicines into use, and he recommended and employed opium, senna, and other important medicines. Van Helmont was a writer on medical chemistry who flourished in the sixteenth century. Glauber, who lived about 1620, discovered muriatic acid, and knew that vinegar could be obtained from wood. About the close of the seventeenth century the progress of chemistry received great assistance by the establishment of several Institutions. To the *Royal Society in this country and the Royal Academy in Paris modern science owes almost all its improvement.* They were, however, preceded in some of their researches by the Florentine Academy. In 1731, Bergman published his Chemical Essays, and he was the first person to point out the use of tests in chemistry. Hales published, in 1717, his Vegetable Statics, which was the first work on the physiology of vegetables, and records many discoveries on the functions of plants. The professor would do no more than mention Boerhaave, Black, Priestley,* and Cavendish, whose discoveries had laid the foundation of the present science. Fourcroy deserved to be noticed as the first person who had arranged the modern discoveries into a regular system of chemistry, and his *Connoissance Chimique* was still valuable, as presenting a very full account of the chemistry of that period. This terminated all the observations which the professor made that at all related to the history of chemistry.

He then went on to define the science, which he said was that branch of physical or natural science which treats of all the changes in the composition of matter, whether they were produced by heat, by mixture, or by any other means. Chemistry, therefore, divided itself into two parts: one treats of the particular properties or powers of matter which concur to produce chemical changes; the other is an examination of the bodies on which these powers act. The powers which modify chemical action are attraction, heat, and electricity. The former not only tends to make the particles of matter approach, but makes them unite, forming aggregate masses. Gravity seems to be the same power, acting at great distances, and on masses of matter, and, combined with the inertia of the planets, kept them in their course. The same power formed some bodies into liquids, others into solids; and of these some were hard and others soft. It acted also on heterogeneous particles, forming what was more particularly called chemical affinity. In his two first lectures he should describe the power of attraction, as far as it was connected with chemical action, and show its influence on the composition and formation of bodies. It had a tendency, in uniting bodies, to make them assume a particular form, so that the nature of crystalline substances might be known from their form, and by

health; thus his name expressed the two things which the alchymists were to produce by the philosopher's stone. We must here caution our readers, not to suppose that Mr. Brande's enumeration of the authors who may be consulted for alchymical information, is any thing more than very superficial. We could dress up a much longer list of alchymical authors, who ought not to be overlooked; and so, we have no doubt, could Mr. Brande; more particularly as we cannot suppose, from his name, that he is quite ignorant of the writings of the Germans.—ED.

* These names, we think, more particularly the latter, should have reminded Mr. Brande of the extravagant praise he had a few moments before bestowed on Royal Societies. Franklin, we believe, never was a member of any such society; and both Mr. Watt and Sir H. Davy were only taken in when their previously acquired reputation conferred honour on the society. Neither Mr. Brande, nor any more eloquent man will now persuade the world that Royal Societies are of any use but to bestow false honours on those persons who are the most skilful intriguers.—ED.

measuring the angles of the crystals. From this fact we might see how physical, mechanical, and chemical science blended with each other. The power opposed to attraction was *heat*. He preferred this name to *caloric*, which implied the existence of a peculiar species of matter. The phenomena might depend on an attenuated substance, but they might also depend on vibrations or motions among the elementary particles. The term "heat," though it stands for both cause and effect, involved no theory, and as its use would create no confusion, he preferred it. He should first consider heat as affecting bulk, or causing expansion. In this part of his course would be included an account of the measures of this expansion, or thermometers. Heat also effected a change in the state of bodies, producing solids, liquids, or gases; and these various changes would be discussed. It was also a fact, that the same quantity of thermometic heat, as applied to bodies, did not produce the same thermometic effects. This was owing to the different capacities of different bodies for heat. For example, if it took 100 parts of heat to raise a pint of water to a certain degree, and it only took 50 parts of heat to raise the same quantity of oil, the water was said to have a greater capacity than oil. This effect of heat would also be explained. The third power was electricity. If a piece of sealing-wax was rubbed with a piece of flannel or a warm dry hand, it was found to emit light in a dark place, to affect the face, if held to it, with a peculiar sensation, and to attract some light bodies and repel others. This simple act, therefore, conferred new and important properties on the wax, and this was electricity. He should explain the names used in this part of the science, and examine the sources and the mode of exciting it, as well as the peculiar methods of producing electricity by the connexion of different bodies, or in relation to the Voltaic pile. A few years ago it might be asked what connexion there was between electricity and chemistry; but by discoveries made, he scarcely need inform them, in that very Institution, it had been made evident that the chemical properties of bodies could be altered by electricity. This had established an important and intimate connexion between chemical and electrical powers, and there was reason to believe that this connexion was more intimate than had been hitherto developed.

After electricity, he should treat of *radiant* matter and its connexion with chemistry. Under this term was included light and heat, and their causes. Radiant matter emanated from the sun, and moves with immense velocity through different media. After radiant matter, ponderable matter would follow. There were two methods generally adopted of treating this species of matter: the first consisted in beginning with an examination of compound bodies, and tracing them up to their elements; the second, in beginning with the elementary substances,and afterwards describing their compounds. The former was the analytic, the latter the synthetic mode of proceeding. By a rigid adherence to either, much inconvenience would be produced; and the plan adopted at the Royal Institution, was first to describe the elementary substances, and to examine the compounds they formed as the elements themselves were noticed. The elementary bodies might be divided into classes, as to their electrical relations, some being positively and others negatively electric. Those were positively electric which were attracted by the negative pole of an electrical battery, and those negative which were attracted by the positive side. There were between 60 and 70 elementary bodies, and all these were capable of combining with each other, and several of them could combine together. There were only three electro-negative, or attracted by the positive pole, viz. oxygen, chlorine, and iodine: the two former were gases, the

latter was a solid. They were only called elements, because they had not yet been decomposed; but there were strong reasons to believe them compounds. Of the elements evolved at the negative pole,* six are simple inflammable substances. The metals also belong to this class. In treating of them, he should give their chemical history, their mineralogical history, and an account of such of their compounds as were useful in pharmacy. After describing the elements, and their several compounds, he should treat of the chemistry of organic matter, and describe the functions of vegetables and animals. Under the former, he should have to consider the numerous changes which take place in them, including fermentation of every kind. Animal chemistry was more complicated than vegetable chemistry, as animal matter was subject to more spontaneous alteration. It had been thought that a close examination of the chemical nature of the different secretions of animals, might throw light on the nature of some diseases. Hitherto such hopes had not been realized; but as the study of this part of the science was prosecuted, some light might be thrown on the nature of particular diseases. During the course he should give examples of analytical chemistry. He should close the course with a sketch of geology, a branch of the science which had great interest, from the explanations it afforded of the nature of the crust of our globe. We yet know little of the nature of our planet, nothing of its interior temperature, and nothing of its interior structure. From geology we learnt that the crust of the globe was arranged every where in a similar order. There were two distinct formations. One never includes animal remains, is a crystallized mass, and perhaps forms the interior of the globe. The other contains animal remains, and appears like the ruins or the wearing away of the former. He should treat of these, and in describing the latter should have occasion to speak of the veins, or rather strata of coals, and beds of rock salt which were found in them, and of the means of raising these minerals to the surface. Lastly, he should terminate with an account of the changes the surface of the globe is now undergoing from changes of temperature, the action of water, and of fire, including volcanoes.

* There is a difference in the nomenclature of chemists. Some call those elements positive electric which are evolved at the positive pole, and those negative which are evolved at the negative pole; Mr. Brande, it appears, names the elements directly the reverse.

CONTRACTION AND EXPANSION OF WATER IN COOLING.

Fill a thermometer tube with tepid water, and immerse it in a glass vessel containing water of the same temperature, in which a mercurial thermometer is placed. If the whole apparatus be now placed in a bed of snow, or in a frigorific mixture, the water in the tube will gradually contract till the mercury shows the temperature of 40°; it will then begin to expand gradually until it becomes ice. From this simple experiment the reader may see, what is otherwise, however, a well-established fact, that the specific gravity of water is greatest at 42°. The expansion of this fluid when cooled still further, is an *exception* to the general law of bodies expanding by heat and contracting by cold; and as we are unable to account for it, or refer it to any class of facts, it seems like a perpetual miracle, and may excite both our wonder and our gratitude whenever it is contemplated. It is in consequence of this miracle that ice swims on water, and does not sink down, choking up the streams and stopping the currents of the rivers, the continued flow of which is as necessary to the existence of the world as the circulation of the blood is to our existence.

DICTIONARY OF CHEMISTRY.

CHLORATES, formerly *hyperoxy-muriates.* Salts consisting of chloric acid united with a base; one of them, the *chlorate* of potash, is distinguished by an extraordinary detonating power when triturated with combustibles.

CHLORIC ACID. A compound of oxygen and chlorine. It was first supposed to exist by Berthollet, and first obtained by Gay Lussac.

CHLORIC OXIDES. Names given to the oxides of chlorine, which see.

CHLORIDES. Compounds of chlorine, with different bodies.—These substances, as far as they were then known, were formerly called *oxymuriates.* Those which contain the least *chlorine* are called *proto-chlorides*, and those which contain most, when only two combinations of chlorine are known, are called *deuto-chlorides.* Thus we have *protochloride* of mercury, *calomel*, consisting, in the 100 parts, of 15.254 chlorine and 84.746 mercury; and *deuto-chloride*, or *per-chloride* of mercury, *corrosive sublimate*, consisting of 26.47 chlorine and 75.53 mercury.

CHLORIDE OF BISMUTH, *butter of bismuth.*

——— PROTO, OF COPPER, *rosin of copper, muriate of copper.*

——— OF LEAD, *plumbum corneum, horn lead.*

——— OF SILVER, *horn silver, muriate of silver.*

——— PER, OF TIN, *fuming liquor of libavius.*

——— PER, OF ZINC, *butter of zinc.*

CHLORINE, *oxymuriatic acid, dephlogisticated muriatic acid, oxygenized muriatic acid.* For a long time this substance was supposed by chemists to be a compound of muriatic acid and oxygen; but in 1810 and 1811 Sir Humphry Davy published his experiments on the subject, and drew as a conclusion, that chlorine was a simple substance, and muriatic acid a compound of it and hydrogen. His opinions are now, since the death of Mr. Murray, the celebrated chemist at Edinburgh, who was, we believe, the staunchest opponent of Sir Humphry's theory, universally adopted, and in consequence, oxymuriatic acid is now called chlorine. The changes in chemical nomenclature which this discovery led to, have been a source of some mistakes and confusion.

———, PROTOXIDE OF. The *euchlorine* of Sir Humphry Davy. A compound of chlorine with the smallest quantity of oxygen with which it is known to combine: or it consists of 81.82 chlorine and 18.18 oxygen.

———, DEUTOXIDE OF. A compound of chlorine with a greater quantity of oxygen: or it consists of chlorine 47.24, oxygen 52.76.

CHLOROIODIC ACID, *chloruret of iodine.* A compound of chlorine and iodine.

CHLORITE. A mineral, having no relation, however, to *chlorine*, but consisting of silica, alumina, lime, oxide of iron, and potash.

CHLOROCARBONIC ACID, *phosgene gas, chlorocarbonous acid, carbo-muriatic acid.* A compound of chlorine and the protoxide of charcoal; and hence the second is the more correct name for it.

CHLOROCYANIC ACID, *oxyprussic acid.* A compound of chlorine and cyanogen.

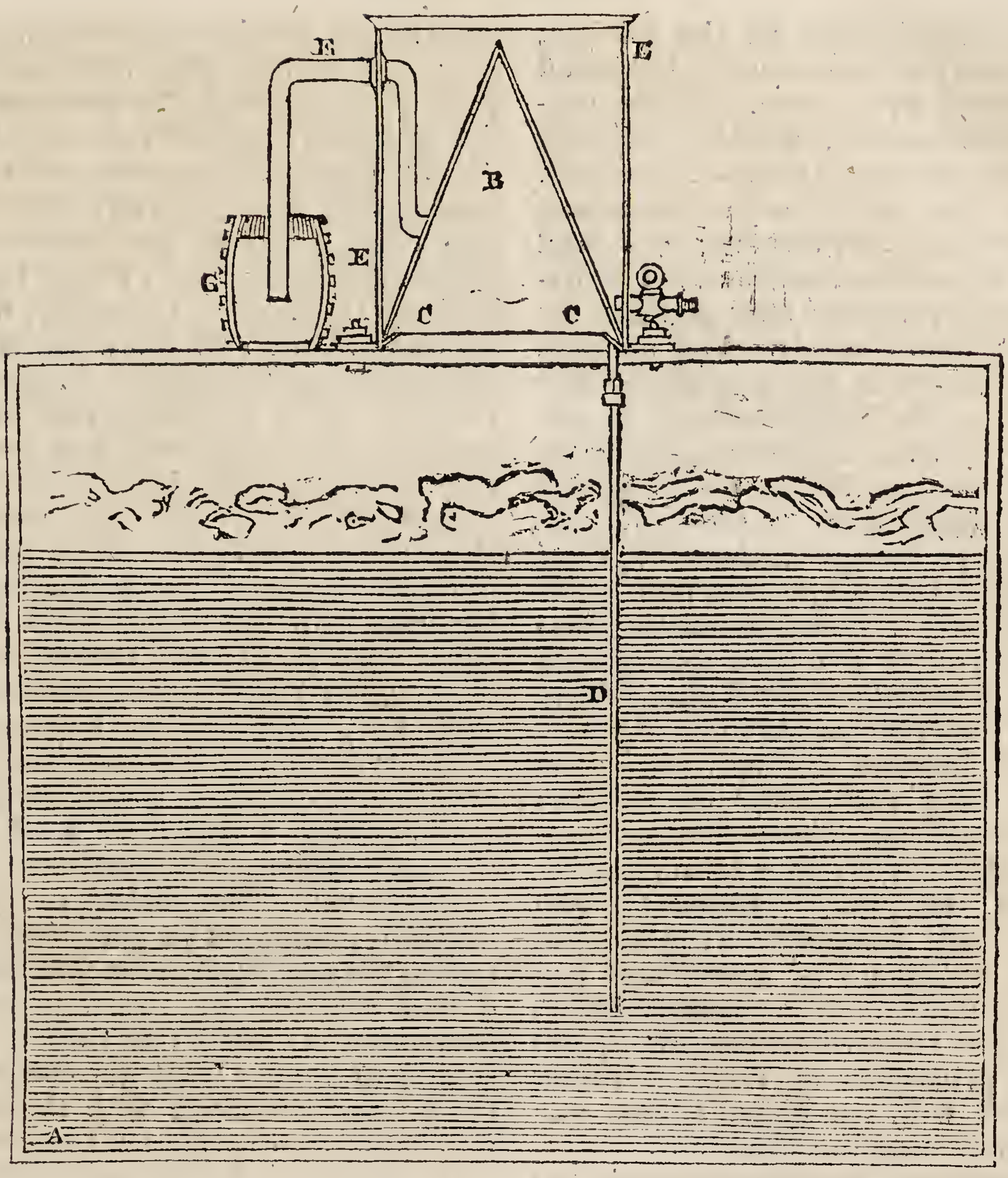
CHLOROPHYLE. The name given by MM. Caventou and Pelletier to the green matter of leaves.

CHOLESTERINE. The name given by M. Chevreul to the pearly substance of human biliary calculi.

CHOLESTERIC ACID. A peculiar acid, which, according to MM. Caventou and Pelletier, is obtained by heating concentrated nitric acid with cholesterine.

CHROMIC ACID. A substance consisting of chromium and oxygen, and containing a larger quantity of the latter than the oxides of chromium.

CHROMIUM. An undecompounded metal, so named from giving a red colour to other bodies. It was first detected in 1797.



MESSRS. DEURBROUCQ AND NICHOLS' PATENT APPARATUS FOR IMPROVING FERMENTATION.

In consequence of a Correspondent having attracted our attention to the patent apparatus of Messrs. Deurbroucq and Nichols, we here lay before our readers a plate and description of it. A A represents a closed vat, in which the process of fermentation is carried on. B is a condensing cone, placed over a hole in the top of the vat. C C is a small channel, extending round the base of the cone on the inside, and intended to receive the alcohol and essential oils which are condensed in B, whence they are conducted down the small pipe D into the vat. E E is a reservoir containing cold water, and surrounding the condensing cone. F is an exit pipe proceeding from the interior of the cone, and terminating some inches below the surface of the water in the small tub G: it is to carry off from B the uncondensed gases which escape through the water in G into the atmosphere. H is a cock for drawing off the water from E, which must be frequently or constantly renewed.

This apparatus is the invention of Mademoiselle Gervais, a French lady and wine manufacturer, and has excited among the people on the other side of the water about the same quantity of contention which the improvements of Mr. Perkins, in the steam-engine, have excited in this. The lady wrote pamphlets, procured certificates, took out a patent, invited her *friends* to see the machine in operation, and puffed it off by every means in her power, though she did not think proper to publish the report made to the *So-*

ciété d'Agriculture on the subject, by some of the most enlightened chemists of France. Other persons, of course, doubted the vast utility of this lady's invention: they even went so far as to say that it was only an adaptation, and not a good one, of the united discoveries, made long before, by Porta and Casbois. The dispute, we believe, is not yet finally settled, as the lady contends to the last; but in the opinion of most of the *savans* at Paris, the invention is of little value. Quackery, however, is always undaunted, and lifts up its brazen face, and trumpets forth its own excellencies as loudly after a defeat as before it was assailed. We are afraid there will never be an end to it, either on the other side of the water or on this; and thus, after the value of Mademoiselle's invention has been reduced in France to its proper level, we find it imported into England, protected by a patent, and puffed off by pamphlets and other means, the same as in France. It shall be our business to explain the principles of this invention, which will, we hope, enable our readers duly to estimate it.

It has long ago been observed, that "the very pungent aromatic odour which carbonic acid has when disengaged from the fermenting tun, shows that it *carries off* with it a *portion* of the *wash*, and this has been verified by actual experiment."* Now, it is plain that this portion of the wash may be easily condensed, and thus separated from the carbonic acid gas. The use of the cone placed over the vat is to condense and separate it. So far, then, this condensing cone is an improvement on an open vat; and the principle involved in it of carrying on the fermentation in close vessels is no doubt a correct one. But this principle is already acted on by our distillers, and was also in France, long before Mademoiselle Gervais puffed off her condensing cone. The celebrated and unfortunate Rozier* recommended long ago to the wine makers of France to conduct the fermentation in vessels carefully closed. In Champagne and Burgundy his recommendation is generally carried into effect; but in the south of France the wine makers being, like ignorant men in all countries, the slaves of habit, still allow the fermentation to take place in open vessels. It is by comparing her process with fermentation in open vessels that Mademoiselle Gervais makes out an increase of a ninth to a fifteenth of the volume of wine obtained; while, on comparing her plan with the fermentation in close vessels, M. Gay Lussac has ascertained that it is not above a 200th part. This saving, however, is the principal or only advantage which her invention has over the ordinary and long-known method of conducting fermentation in a close vessel. The author of the English pamphlet on the subject makes the saving between four and a half and five per cent. in the fermentation of beer; but we have reason to believe that his comparison was also made with the old method of fermenting beer in open vessels; and even this species of fermentation has been, in many cases, carried on in close vessels long before Messrs. Deurbroucq and Nichols imported Madmlle. Gervais's method into England. The obvious advantage of this method is, that it condenses and saves that portion of wine, of wash, or of alcohol, which always flies off with the carbonic acid gas.

Practical men, as well as theorists, have long come to the conclusion, that the fermenting process itself is rendered more com-

* Thomson's Chemistry, vol. iv.

* Pilatre de Rozier was an enterprising and enthusiastic chemist. In July 1785, he ascended with M. Romaine in a balloon from Boulogne, intending to cross the Channel. They had not, however, been long in the air, when the terrified spectators observed the balloon on fire. They did not long wait in anxious suspense for the completion of the tragedy: Rozier and his companion were precipitated to the ground and dashed to atoms.

plete in close than in open vessels. This principle was not discovered by the possessors of the present patent, nor is their particular adaptation of it the most happy. The exit of the carbonic acid gas is at a distance of six inches under the surface of the water, thus adding so much pressure on the fermenting fluid. One consequence of this is, that the process is rendered less active, and takes a longer time to complete, as is the fact. Whether this increased pressure is of service to the fermentation or not, is another question. It is quite certain that the extraction of the carbon is necessary, and therefore we are disposed to believe that the increased pressure, without making the products better, only makes the process slower. The original inventor, however, seems to have had no idea of any such effect; and the increased pressure is rather an accidental consequence of the invention than intended to work any benefit. Another consequence is, that the compressed gas has a greater expansive power; and as it is almost impossible to make the lutings perfectly tight, a part of it escapes, and carries off a portion of the wash. What is still worse, as the fermentation decreases in activity, the atmospheric air finds admission where the gas was forced out when the operation was most violent. After the liquid is condensed according to this method, it falls back again to the fermenting vat, and being much colder than the liquid in it, also checks the process, and is partly the cause of its continuing so long. Admitting the utility and saving of fermenting in perfectly close vessels, it becomes a question if this could not be effected without the inconveniences of Miss Gervais's method. We think it could, but it is probable that the patent of Messrs. Deurbroucq and Nichols would stand in the way of its application. For example, the fermenting tubs might have air-tight lids, through the centre of which a small tube communicating with the inside of the tubs, and with a condensing apparatus at a distance, might be easily inserted. Where several fermenting vats are employed at the same time, the small tube from each may be carried to one large tube, and thus one condensing apparatus may serve for the whole. The end of the large tube, after passing through a cooler, should terminate in a small tub, into which the condensed liquor falls, while the carbonic acid gas, from which it is separated, escapes. The small tubes might also each have a cock, so as to cut off the communication at pleasure. By means of an apparatus so constructed, the saving made by that of Mademoiselle Gervais might be effected without in the least impeding the fermentation by additional pressure, or sending back the cold liquid into the fermenting tub. We doubt, however, whether such an apparatus would not infringe on the patent rights of Messrs. Deurbroucq and Nichols, and thus it is not one of the smallest evils of the claims of such people, that they impede others in making improvements. In conclusion, we have to observe, that all the observations in the English pamphlet about regularity of fermentation, exclusion of the principle of acidity, &c., apply to fermentation in close vessels; and this, though much to be recommended, is not peculiar to the patent method here brought under notice.

DISTILLERS' LUTE.

Take two parts of whiting, one part of meal, and one-fourth of salt, and add the necessary water to make a thick paste. When the apparatus is shut, put a certain quantity of the lute round the head, applied on some strips of paper, and upon the paper another portion of lute; it will dry very soon, and keep very well. It will be easily understood that the salt has no other virtue but to facilitate taking off the lute when the operation is over, by pouring some water on it.

A. D.

CHEMICAL LECTURES AT THE MECHANICS' INSTITUTION.

On Wednesday evening Mr. Cooper began to deliver a course of lectures on chemistry at this Institution, to which we mean also to attend in their progress. It will afford us a good opportunity of contrasting the mode of teaching the science of chemistry to two very different classes of society, and at very different prices. Of the first lecture, which was principally occupied, like Mr. Brande's, by an outline of the course to be given, we are unable this week to say any thing more than to give this short notice.

ILLIBERALITY OF SCIENTIFIC MEN.

The readers of The Chemist are, we should suppose, by this time aware that we have no respect for that principle of party or of sect among scientific men, which induces them to overlook or decry every invention not made by that particular genius whom they follow and worship,—hoping, apparently, to share the exalted reputation they seek to obtain for their idol. There is no surer sign of a mind not at ease with itself, and greedy of praise beyond its deserts, than a jealous apprehension of the discoveries of other men. However acute and skilful these jealous persons may be, those who can bear no rival in scientific reputation,—who, instead of continually enlarging their knowledge by the information derived from many minds, (and the humblest intellect may sometimes add a ray of light to the most dazzling genius,)—confine themselves to their own observations, and will hear of nothing but their own discoveries, may deserve the appellation of clever men, but assuredly they are not philosophers. Almost every scientific journal of any reputation is in our country merely the organ of some sect or party, and is much less intended to promote knowledge than to bolster up or propagate the reputation of individuals. In the short career we have hitherto run, we have observed several acts of neglect or injustice committed by them all towards men not of their own party. Hereafter we shall probably bring forward the instances we have ourselves observed; at present we mean to quote some observations on this subject, which have been made in an American publication. We have a sufficient guarantee, both of their justice and moderation, in the fact of their being inserted in the Philosophical Magazine, which respects too much all those at the head of science to offend them unnecessarily. By drawing attention to the illiberality of scientific men toward one another, while, as far as lies in our power, we do ample justice to them all, we shall assist in shaming them out of their narrow-mindedness; or at least we shall teach the public to bestow no more respect on them than is their due. After describing an hygrometer, the invention of Mr. Daniel, and praising it very much, the American author goes on to observe:—

"It is to be recorded, to the disgrace of European science, that this instrument, so simple in theory, and so beautiful in its practical application, has, from motives of local jealousy, not yet received the notice and the long-wished approbation to which it is entitled. In Edinburgh, Professor Leslie, bigotted to his own inventions, and full of his views of applying his differential thermometer to this among a variety of other uses, has, in his article On Meteorology, in the Supplement to the Encyclopœdia Britannica, entirely passed over the invention of Mr. Daniell; and after stating casually the principle on which it is founded, contented himself with saying that it might be of value could it be 'easily and nicely reduced to practice.' In Switzerland, the editors of the *Bibliotheque Universelle* affect to think that Mr. Daniell could not have been acquainted with Saussure's hygrometer, or he would not have thought it necessary to construct a new one, al-

though Saussure's papers may be quoted as the evidence of the imperfections of his own instrument. The philosophers of France, with the blindness of national prejudice almost equal to that manifested by the mathematicians of England, when for a quarter of a century they disdained to profit by the brilliant inventions of Laplace and Lagrange, have passed Mr. Daniell and his discoveries without notice; while in London he has to contend with the whole weight and influence of the President and Council of the Royal Society, in consequence of his having pointed out the extreme negligence with which the Meteorological Register, published under the sanction of their authority, was kept."

ANSWERS TO QUERIES.

DIRECTIONS FOR PREPARING MODELLING WAX.

Melt an ounce of white wax in a tea-cup, by putting it into boiling water, taking care that the water does not flow into the cup; let it stand till cold, then melt it again the same way, and when quite dissolved, put in by degrees, stirring it all the time, a little white lead, and about the size of a nutmeg of Venice turpentine (which makes it ductile, and gives it tenacity.) The colour, if you wish to give any, is made by adding a little vermilion. The cup, in a pan of hot water, must be held over the fire a little, before it will melt, and when melted poured into a basin of cold water.

Your correspondent, E. R. W. (p. 16, No. 29), will find ample instructions for stuffing and preparing birds, in two small volumes, the one published by Mr. William Bullock, to be had at the Egyptian Hall, Piccadilly, and the other by Mr. William Swainson, to be had at Mr. Wood's, bookseller, Strand. It is not generally known that, for very small birds, ether acts as a preservative. The bird should be held up by the head, and a quill inserted through the back down its throat, and every day a few drops poured down; and the bird should, during the process, be exposed as much as possible to a current of air: the swift evaporation of the ether dries up the flesh and other corruptible matter.

A. Y. S.

QUERIES.

If, in return for the foregoing, you would insert a query in your next Number, "requesting to know the mode adopted in Italy, by sculptors, in the preparation of their modelling clay, which is afterwards submitted to the action of fire, and becomes perfectly hard," you will oblige

A. Y. S.

Mr. Editor,—I should wish that some of your numerous correspondents would give, in your work, a description of a soda water apparatus, such as is generally placed on counters in confectioner's shops, and are drawn out by means of a stop-cock; and the method used for filling bottles with the water.

Yours,
A Subscriber.

The best method of cleaning damaged and mildewed engravings?

TO MEASURE THE COMPARATIVE LIGHT GIVEN BY LAMPS OR CANDLES.

Place them a few inches asunder, and a few feet or yards from a screen of white paper, or a white wall. On holding a small card near the wall, two shadows will be perceptible on it, the darker one by the interception of the brighter light, and the lighter shadow by the interception of the lesser light. Either bring the fainter light nearer, or remove the brighter farther from the card, till both shadows appear exactly alike, of which the eye is a very good judge. The square of the distance of each light from the wall or screen, gives the ratio of its illuminating power. If an argand flame, for example, and a candle stand at the distance of 10 feet and 4 feet respectively, when their shadows are of equal intensity we have 10^2 and 4^2 or 100 and 16, or $6\frac{1}{4}$ and 1, for the relative quantities of light.

WATER A BAD CONDUCTOR OF HEAT.

Pour a little sulphuric ether on the surface of a glass of cold water, and set fire to it. The ether will burn for a considerable time, producing a large volume of flame; but when it is extinguished the water will be found not to have been at all heated. This shows that water will not convey heat downwards, and that if we want our kettles to boil, heat must be applied at the lower part.

SIR HUMPHRY DAVY AND MR. CROKER.

There seems at present to be a great rivalry between these two eminent persons. The reason of this, we believe, is, that both aspire to the character of a universal genius. The versatile Secretary of the Admiralty, who is already known as a caustic reviewer, a sketchy historian, a horn-book writer, a gruff man of business, a profound politician, a parliamentary orator, and——a wit in society, and a philosopher in the closet, has lately added to his other acquirements a knowledge of chemistry, and aims at outshining, or at least posing, SirHumphry in his favourite science, as he has posed Mr. Hume in the House of Commons. The Secretary is said, above all things, to shine in society, and is known as one of the most incessant talkers of the day. On the other hand, the President, not contented with being the first chemist of the age, aims at being a man of ton, and at rivaling Mr. Croker as a public orator and private talker. He is said to be one of the most exquisite triflers of the day, making quite a figure in the drawing-rooms of *good society*. Whether this is the source of the disagreement at present existing between these gentlemen or not, the rivalry and the dispute are evident. Sir Humphry has been attacked in the John Bull Magazine, and Mr. Croker in the Morning Chronicle. In reply to this latter attack we have received the following communication, which, as it is interesting, and tends to assist our wish to reduce aristocracies in science to their proper level, we shall insert; though rather out of the line we have marked out for ourselves; which is to record the facts of the science, and not trouble ourselves with the personal disputes of its friends and professors.

To the Editor of the Chemist.

And damn the arts which caused himself to rise. *Pope.*

Mr. Editor, — I remember to have seen a fencing-master in a violent rage at being hit by a bumpkin; and on the same principle the French, whenever we beat them, exclaim against our inveterate stupidity, in having gained a victory contrary to the rules of the art military. Thus it is, too, with some ultra chemist, who has taken up the cudgels for Sir Humphry Davy against the Secretary of the Admiralty.*

Your readers may be aware that the rapid consumption of copper sheathing had attracted the attention of the Lords of the Admiralty, and that his Majesty had referred it to a *Committee of Chemists*, of which Sir Humphry was *Chairman*, to inquire into the causes and remedies of this evil; but the public may not have been informed that after a single meeting, the Chairman abandoned the *joint* research, and applied himself *individually* to the subject.

I by no means mean to insinuate that the learned President received any hint from his cook, as to the action of salt and water on copper saucepans, or of the preserving power of tin; I will rather conclude that the information was obtained from Pliny, or Professor Proust, or Doctor Paris, or, yet more probable, from Sir Humphry's own galvanic experience; be this as it may, a disk of tin was first proposed as a preservative of the copper sheathing; now iron is to be used as a cheaper substitute; which brings us back to the old observation, that when iron bolts were used with copper sheathing, the

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* Morning Chronicle, Oct. 2.

bolts decayed, but the sheathing remained bright and perfect; when copper bolts were used, the sheathing decayed. Thus it is evident, that there was little originality in Sir Humphry's application of a galvanic action.

There is, however, a more serious objection to the method proposed: It has been tried, and it has failed. *Hinc illæ lacrymæ.* *

It appears that the Secretary of the Admiralty wished to be convinced, by such simple means of experiment as were in his power, of the value of the supposed discovery; he submitted it to the test of his vinegar cruet; he was wrong; he should have resorted to his salt celler. Is the error really so great as to justify the outcry raised against it by Sir Humphry Davy and his friends? We happen to know that the profoundest of the English chemists discards the fopperies of apparatus, and keeps his laboratory within the compass of a tea tray; a few glass tubes, a blowpipe, some twenty little phials, and three or four wine glasses, suffice for his experiments.† Sir Humphry himself started in his chemical career with the humble means which an apothecary's shop, at the Land's End, could afford him. What would not the world have lost, if Mr. T—— had snubbed his assistant with, "Leave my gallipot alone, Master Humphry, and mind your own business; rub up that *unguentum hydrargyri*, and leave chemistry to your betters."—The young *chip* might have followed the fate of the old block; or, at best, have assisted in peopling the churchyard of Penzance. Fortunately, there was no vinegar cruet critic to check the ardour of the young aspirant. The celebrated Doctor Beddoes took him into his laboratory as an assistant, and there the learned President laid the foundation of his well deserved fame and fortune.

The aristocracy of chemistry would fain confine the science to their own class, on the same principle as the Royal Society accepts title or fortune as a qualification for the fellowship, when knowledge happens to be wanting. If a man cannot afford to expend five hundred pounds in apparatus, let him stick to his work-shop. Philosophy in a vinegar cruet! science in a salt cellar!! forbid it peers, princes, and prelates—forbid it ministers and secretaries. Oh Mr. Croker, Mr. Croker, if you set such levelling examples in science, what will become of us! Shall the Mechanics' Institution rival Somerset House? shall unwashed artificers compete with laced ruffles? We have had some sad rubs already from the vulgar; but this from you, *et tu brute*.

Fortunately, however, the spirit of the age does not accord with the views of the dandy philosophers; they may black-ball at Somerset House, segregate from Albemarle-street, or shut themselves up in the atheneum; they may drive themselves into a corner, like the exquisites at Almack's; but they will only, like them, have the mortification of seeing that the world goes on better without them.

I have the honour to be, &c.

A CONSTANT READER.

* Failed in no other way, apparently, than that copper so disposed does not keep so clean as copper in a constant state of decomposition. It has been found, we understand, that ships' bottoms coppered on Sir Humphry's plan soon get remarkably foul.—ED.

† It is also recorded of Dr. Franklin, Dr. Priestley, and Mr. Watt, that the apparatus with which they made their most valuable discoveries, consisted in a few pipe-bowls and common phials.—ED.

POLLENINE.

DR. JOHN has given this name to a substance which he has discovered in pollen. He describes it as being yellow, insipid, inodorous, insoluble in water, in alcohol, in ether, in volatile oils, and in petroleum. It burns with a flame. Exposed to the air, it soon acquires the smell and taste of cheese; soon putrefies, and ammonia is disen-

gaged. It holds a middle place between gluten and albumen.—*Bulletin des Sciences Technologiques.*

To EXTRACT and PRESERVE the RED COLOUR of CABBAGE.

Digest the leaves of the cabbage in warm alcohol, and when the whole of the colouring matter is extracted, distil off a portion of the spirit, and evaporate the remainder at a very gentle heat to the consistence of a syrup. This extract may be preserved unimpaired for years, if kept in phials closely stopped. To use it, add a small portion of it to water, when the addition of an alkali or acid will produce its peculiar effect. To employ this test to detect small quantities of carbonic acid, add to it a little diluted alkali, which will make it green; and the acid, by neutralizing the alkali, will restore the blue colour. Test papers may be prepared by means of the alcohol tincture of the cabbage, which, when rendered green by immersion in a diluted alkaline solution, may be used in all those cases in which litmus papers are commonly employed.

PRUSSIC ACID.

It is said by Mr. Becker that this acid destroys vegetables as well as animals. We have already stated its poisonous effects on them. Seeds steeped in it either die or lose the power of germinating; and the more delicate the vegetable the more rapidly it perishes.

ILLUSTRATION OF THE PHOSPHORESCENCE OF THE OCEAN.

Pour a little phosphuretted ether on a lump of sugar, and drop it into a glass of tepid water. In a dark place the surface of the water will become very soon luminous, and if it be moved by blowing gently with the mouth, beautiful and brilliant undulations of the surface will be visible, exhibiting the appearance of liquid combustion. Those who cannot see the ocean in a flame may adopt this feeble mode of imitating it, and it will serve to give them a faint idea of a phenomenon which has called forth the admiration of all who have ever seen it, and which has been recorded by Lord Byron in noble poetry.

IGNITION BY HYDROPHOSPHORIC GAS.

Mr. M. J. B. Von Mons has announced in the *Journal de Pharmacie*, that on kindling phosphuretted hydrogen, not spontaneously inflammable, the bubbles which were slowly generated, maintain the ignition of a lighted match without inflaming it, and were themselves inflamed by the incandescent flameless body. In the experiment of the philosophical candle, after the hydrogen has burnt for some minutes, the tube is made sufficiently hot to relight the gas immediately after blowing it out. Now M. Von Mons says, that the hydrogen of this candle inflames spontaneously if the mixture of the sulphuric acid and water be made in the bottle itself.

TO CORRESPONDENTS.

Mr. Evans' address is Bread-street, Cheapside.

E. K. has been received. A plate of polished iron immersed in his wine may be of some service, but we should suppose it can never be perfectly safe to drink it.

A Subscriber will find the pamphlet he was good enough to entrust us with has been left at our Publishers' for him.

We must inform all our Correspondents, that in general no communications can be inserted which do not reach us by or before Monday; and Correspondents cannot even be noticed whose communications do not reach us by Wednesday.

In consequence of the length to which the report of the Lectures on Chemistry at the Royal Institution has run, we are obliged to postpone the Articles on Chemistry; but we have no doubt our readers will find their place well supplied by the Lectures.

*** Communications (post paid) to be addressed to the Editor at the Publishers'.

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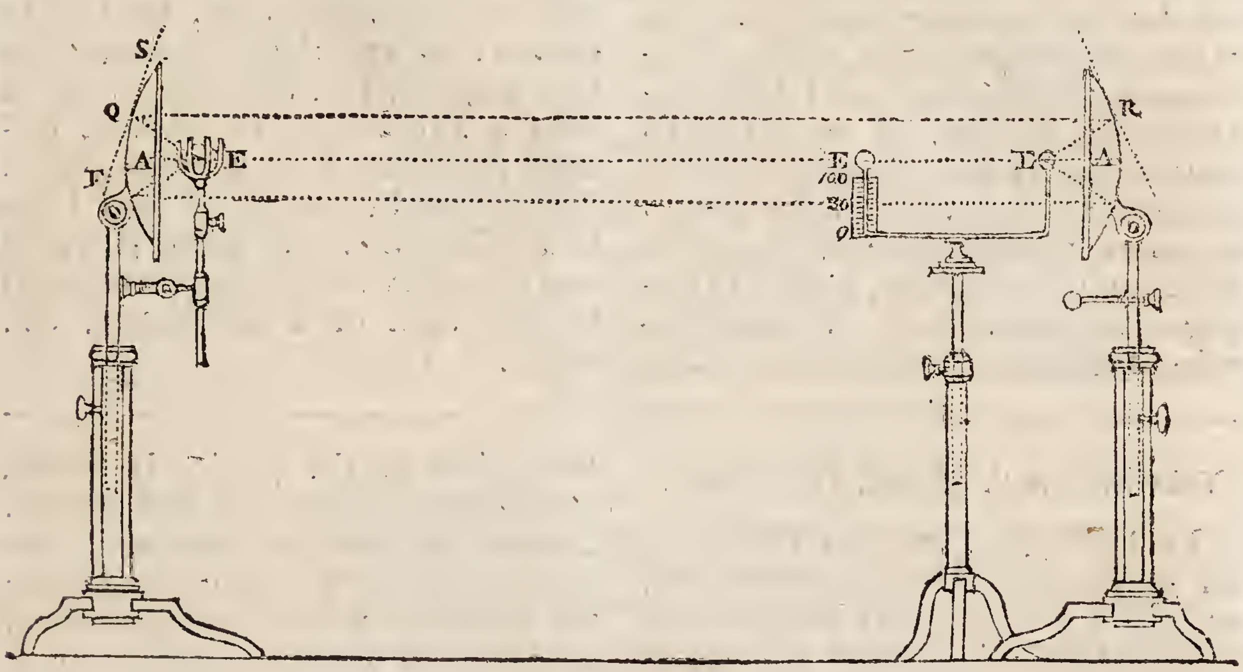
The Chemist.

No. XXXII.] SATURDAY, OCTOBER 16, 1824. [Price 3*d*.



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RADIATION OF HEAT.

SCHEELE was the first chemist to notice the fact of heat radiating from all bodies, and since his time many curious experiments have been made on the subject. Our little plate represents the apparatus first employed by Professor Pictet, of Geneva, for the purpose of showing that heat may be reflected and concentrated like light. Two concave mirrors, A A, are placed some yards apart. A ball, about two inches in diameter, heated, but not so as to be luminous, or any other hot body, is placed in the focus E of one mirror, and one bulb of a differential thermometer is placed in the focus E′ of the other, the other bulb of the thermometer being betwixt E and E′. The rays of heat proceeding from the ball E, in the direction Q E, to the first mirror, are reflected from it in the straight lines A A, Q R, F F, to the other mirror, and thence they are converged on the bulb of the thermometer at the second focus E′; so that this bulb is heated to a

considerable degree higher than the other bulb of the thermometer, which is much nearer than it to the heated body. If a ball of snow, however, or any other cold body, be substituted for the heated ball, the thermometer is found to sink from the reflected cold as it rises from the reflected heat. This latter very curious circumstance has been explained, by supposing that all bodies radiate caloric; and when the temperature of the thermometer is the same as the surrounding bodies, it receives as much heat as it emits, and thus remains stationary. But a body with a lower temperature takes more heat than it receives, and its temperature rises while the temperature of all other bodies falls. The mirrors make the interchange of rays between the cold body more intense than the interchange between any other of the neighbouring bodies, and thus the thermometer falls. We are disposed to regard this as a very incomplete and insufficient explanation; but not having a better to offer, we must leave its elucidation to the ingenuity of our readers. We may remark, however, that it is curious to see the fact, stated in this experiment, brought to prove heat a substance, because it follows the same laws as *light*, when it is not yet established that light is a substance, and when it wants one *element*, which is quite essential to the idea of a substance, viz. FORM.

VESUVIUS A MINE OF SALT.

In 1822 this volcano threw up an enormous mass of a substance, so full of sea salt that the poor inhabitants of Naples and its neighbourhood hastened to lay in a stock of it for their domestic uses. M. Jules de Gaillard lately made the Museum of Natural History at Paris a present of a piece of this substance, weighing about thirty pounds, which M. Laugier has analyzed. At first view it appears composed of two distinct substances, one of which, forming two-thirds of the whole, is white, crystalline, lamellated and friable, having the taste of sea salt, but leaving behind a slight bitterness; the other of which, being reddish brown, with a taste slightly salt, is harder than the former, and evidently contains a considerable quantity of red oxide of iron. These two substances could be separated mechanically from each other, and after this was done, M. Laugier proceeded with his analysis. He found in 100 parts of the white salt substance the following ingredients:—

Substances soluble in water	Muriate of soda	62.9
	Muriate of potash	10.5
	Sulphate of lime	0 5
Substances soluble in hot water	Sulphate of lime	0.6
	Sulphate of soda	1.2
Substances insoluble in water, mixed with potash	Silica	11.5
	Oxide of iron	4.3
	Alumina	3.5
	Lime	1.3
		96.3
	Water and loss	3.7
		100.0

Memoires du Museum d'Histoire Naturelle.

LECTURES ON CHEMISTRY AT THE ROYAL INSTITUTION.

Crystallization, or that peculiarity which exists in most bodies to arrange themselves, when freely suspended, into one determinate form, and no other, was the subject of Mr. Brande's second lecture. The professor first spoke of what may be called the practical part of making crystals, and then he gave a slight account of the theories which have been suggested to account for their formation. The aggregation of bodies into masses is the result, the class was informed, of attraction among homogeneous particles; and chemical affinity was the same power acting on dissimilar particles. The result of the power of attraction is different in different substances; in diamonds and rock-crystals it produces a very hard mass; in chalk the mass is soft. A similar difference may be observed in liquids; and some, like sulphuric acid, are much more dense than others--water and ether, for example. Cohesion, again, is the attraction between the surfaces of bodies, an example of which is found in the adhesion of two pieces of glass or polished marble. Sometimes the particles are arranged without any apparent form, as in chalk; while in others they assume a regular and beautiful form, and are also always of the same figure in the same substances. Art can imitate nature, and form crystals such as she forms; and it also makes substances crystallize that are never found to do so in nature. Substances of the same chemical elements always have crystals of the same form, and however diversified they may appear, they may, by skill and management, be reduced to this form, in which they always exist, and which may be called their primitive form.

That substances should crystallize, it seems necessary their particles should be fully at liberty to arrange themselves. Hence, to produce crystals, the substances must be dissolved, and there is reason to believe no crystals are ever formed but from solutions. Water for example, dissolves a certain portion of salt when cold, it will dissolve still more when heated, and thus there are hot and cold saturated solutions. If after salt is dissolved, the water is drawn off or evaporated, the salt crystallizes. In the specimen exhibited, nitre, these crystals are always six-sided prisms; in Epsom salts the crystals are four-sided prisms; in common salt cubes, and so on. The regularity and size of the crystals depend on the mode in which they are made. If slowly deposited they are proportionably regular, while, if the evaporation is rapid, the crystals are abundant but small. When a pellicle forms on the surface of a solution, it is a sign of saturation, and the water will not dissolve any more salt.

Some substances, which cannot be dissolved in water, are made to crystallize by igneous fusion. The metals belong to this class of bodies. If either lead or bismuth be melted in a common ladle, allowed to cool on the outside, and then the interior, and still liquid metal be drawn off, it will be found internally full of crystals. In the case of lead, these are octoëdra, but bismuth shows the phenomenon more brilliantly. When bodies are vaporized also, and cooled, they sometimes form crystals. Snow is the crystals of vapour of water; oxide of antimony also crystallizes by rising in vapour, and, on cooling, shoots into needles some feet in length.

It is curious that most crystals contain a certain definite proportion of water of crystallization, and this quantity is not merely mechanically mixed with the crystal, it is essential to its existence. When, by being exposed to the air, crystals lose their water of crystallization, they fall into powder, and are said to effloresce. Deliquescent crystals are those which attract water from the atmosphere, and become liquid. Some crystals do neither, and they are those which contain no water of crystallization. A good method of preserving crys-

tals is to immerse them in oil for some time, and then wipe them dry; the oil varnishes them, as it were, and preserves them from the action of the air. Crystallization is promoted by putting sticks or other substances into solutions; and this is a good method for obtaining large and regular crystals. Strings are drawn through syrup, and on them sugar-candy crystallizes, as is generally known. Citric acid is crystallized on horse-hair. When perfect crystals are desired, a substance is immersed in a solution; the best crystals on it are selected, and again immersed in another saturated solution of the same salt. By throwing a handful of ready-formed crystals into a solution of any salt, the crystallization is promoted; and if the solution contain more than one salt, and some crystals of each be thrown in, each salt as it crystallizes will go to its own crystals, so that this method is sometimes employed to purify salts. The accession of the atmosphere influences crystallization, and so does light. A solution of Glauber's salts, which will not crystallize in a close vessel, becomes almost a solid mass the instant it is uncorked. The crystals of camphor, as well as of other bodies, are always most copious on the sides of the vessel exposed to light. Some saline solutions form aborescent crystals, which will sometimes extend over the top of the vessel, and descend on its outside.

As to the theory of this beautiful arrangement, in which harmony of form is seen to pervade the most minute portions of matter, the professor was very brief. Diamond cutters have long known that these crystals are more easily divided or split in one direction than in another. Carbonate of lime exhibits the same phenomena in a more extensive manner; and on following up the divisions which it seems thus naturally to offer, it is at length found that every portion of carbonate of lime crystallized may be reduced to a rhomboidal figure. Romé de Lisle was the first person to observe this phenomenon, and to reduce the study of crystallization to some order. He found the rhomboid embedded, as it were, in every crystal of carbonate of lime, and the angles of these rhomboids are all definite. To measure the angles of crystals, instruments have been invented, called goniometers; and that invented by Dr. Wollaston for measuring the angles indirectly by a ray of light, is a very ingenious instrument.* According to the Abbé Hauy, there were in nature only six primitive forms of crystals, and three integral elements; and all the variety of shape and form met with in crystals was some compound of these. Subsequently, Dr. Wollaston has shown that all these varieties may be explained and accounted for, on the supposition that there is but one primitive form, viz. that of a sphere,—a supposition that has been in some measure confirmed by an observation of Mr. Daniel's. This gentleman found that a crystal of alum, when immersed in water, did not waste away equally on every side, but unequally, and in such a manner as might, *a priori*, have been expected had this crystal been formed out of a multitude of spheres: the parts wasting first where, on such a supposition, the spheres would be protected by fewest points of attraction to one another. The great use of crystallography is to determine the chemical elements of bodies. It is now established that bodies consisting of different chemical elements assume different crystalline forms; and thus a difference either in the forms of crystals or in the angles of these forms, is sufficient to decide that bodies are not chemically the same. In the arts, also, crystallization is largely employed for the purification of salts and certain other substances, which makes a knowledge of the laws

* A description of this instrument will be given in another Number.

which direct it of some importance.*

Chemical Affinity, or the attraction of heterogeneous particles, was the subject of the third lecture. The characteristics of substances, in this point of view, cannot be known till they are subjected to experiment. Sulphur and copper, which, in their ordinary state, have no effect on each other, if brought together, combine with chemical action if heat be applied to them, and the result is a compound called sulphuret of copper, differing in colour and texture from both the sulphur and the copper. If into a glass vessel, from which the air has been expelled, some sulphur and copper be put, and heat be applied, the two combine, evolving much light and heat, and another substance is formed. We observe by this experiment (which the professor made) that the substance produced differs from its elements, that light and heat are evolved, and these two substances will unite in certain proportions only. By chemical affinity, when bodies unite, a *change of form* is effected. Glauber's salts and nitrate of ammonia, for example, both solids, produce, when united, a liquid; as muriate of lime and carbonate of potassa, both liquids, form a solid. The result of mixing nitric acid with alcohol is a gaseous body, while ammonia and muriatic acid, both gases, form, when mixed, a solid. In some cases, as when sugar and salt are mixed with water, the liquid becomes salt or sweet, and thus the compound does not differ in its characteristics from what we might expect. In others the characteristics of the elements are totally altered, or disappear in the compound. Thus in the mixture just made of an acid and an alkali, the result was a neutral salt, having none of the properties of either. If to a vessel containing nitrous oxide gas, which is not soluble in water, a certain proportion of oxygen gas be added, the result is an orange-coloured gas, which is very soluble in water, and possesses other properties different from the nitrous oxide. (This experiment was performed.) This change of form by chemical action is not confined to processes of art: nature carries on many of her operations in the mineral, animal, and vegetable kingdoms by these means, and effects in them all numerous changes. The resulting characteristics could never be known by inspecting the substances, and can only be ascertained by experiment. Thus from the union of the two aerid matters, sulphuric acid and potassa, sulphate of potash was produced, possessing none of the acrid, corrosive, or poisonous properties of either the sulphuric acid or the potassa.

Change of Colour is also a consequence of chemical action. Vegetable blues are changed by alkalies to green, and by acids to red and white. All the three colours are quite destroyed by chlorine. In these few changes, and on these principles, might be traced the art of bleaching and calico printing.

The Specific Gravity of bodies also undergoes a change by chemical action, and is very seldom the mean of the specific gravity of the elements. If water and alcohol, or spirit of wine, be mixed, the specific gravity of the mixture is considerably greater than the mean of the two. By pouring water into a long tube, pouring spirit of wine on it through a glass funnel attached to the tube, and having a very small bore, and then turning the tube upside down, so that the alcohol is at the bottom, the mixture of the two liquids takes place gradually, and the condensation of the two is shown by their occupying a considerably less space in the tube. Elevation of temperature is also a consequence of chemical action. When sulphuric acid is mixed with water, the temperature rises

* Mr. Brande illustrates the possibility of forming every variety of crystal out of a sphere, according to Dr. Wollaston's hypothesis, by means of several models, which makes its probability more evident than it can be made by mere description.

above the boiling point. The aggregation or cohesion of particles is an obstacle to chemical affinity. Chlorine only affects the surface of a piece of antimony; but if this metal, in a state of powder, be thrown into chlorine, they unite, emitting both flame and heat, and chloride of antimony is formed. Sometimes the attraction of aggregation is diminished by solution, which enables bodies to act on each other.

Elective affinity, as it has been called by several chemical writers, though this language is not now so much used as formerly, means, that different bodies possess different powers of attraction for each other. Thus, if nitric acid be poured on lime and magnesia, it takes only the lime. Substances possessing a greater affinity for one another, decompose substances possessing a less; and tables have been constructed of the affinities of different substances for other substances. For a reason to be afterwards explained, such tables are not of great value, and may sometimes lead the chemist into error. A table of the affinity of sulphuric acid for some earths and alkalies was then exhibited; and the order in which the affinity between sulphuric acid and these substances is strongest, is as follows:—

Sulphuric acid.

Baryta.
Strontia.
Potassa.
Soda.
Lime.
Magnesia.
Ammonia.

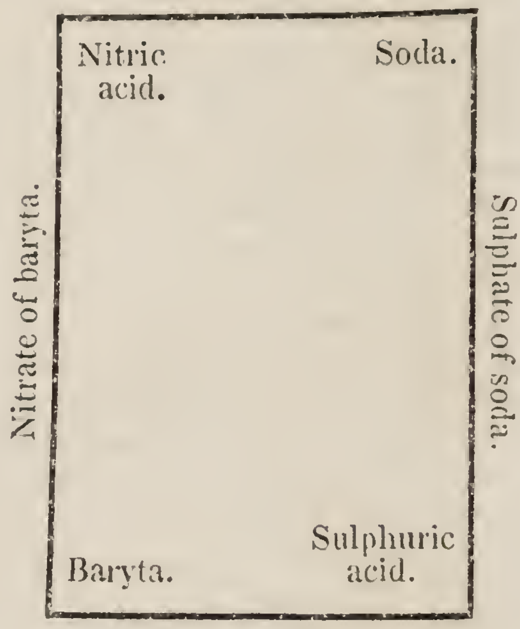
There is also what is called double elective affinity, which consists in a double decomposition, and in the formation of two new compounds. Thus, when a solution of nitrate of baryta is mixed with a solution of sulphate of soda, a nitrate of soda is formed, which remains in solution, and a sulphate of baryta, which is precipitated. To represent these double affinities, diagrams have been formed by Bergman and other chemists, which are of some use. Thus—

Nitric acid.—————————Baryta.

Sulphuric acid.—————Soda.

Bergman's diagram for the same purpose, seems however the most complete.

Nitrate of soda.

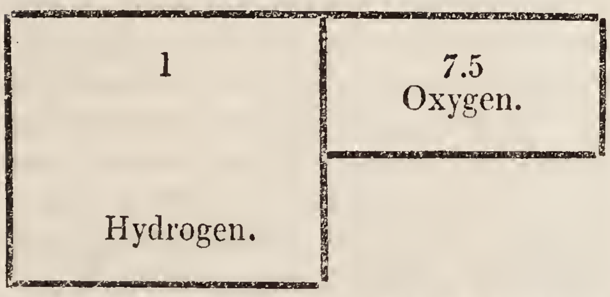


Sulphate of Baryta.

The substance which remains in solution is placed at the top, and that which is precipitated at the bottom. Within the diagram at each corner is placed the elements of the substance. The bodies, as before mixture, are placed outside of the perpendicular lines. These diagrams have been lately improved by adding to them the proportions of the different substances they represent, which are necessary for neutralization. Another example of such double decomposition is this: when sulphate of iron and carbonate of potassa are mixed together, there results a carbonate of iron with a sulphate of potassa. The quantity of acid necessary for the saturation of the iron and the potassa is precisely the same, for no free acid is found in the solution, and the interchange

of elements is exact and complete. These results, too, are not casual; they are constant, and are always the same.

From the results being constant, it is plain that this mutual action of bodies on each other is governed by some certain laws. The observations of Richter led the way, but Mr. Higgins was the first person to broach the doctrine of definite proportions, or that all bodies unite only in certain definite quantities. This doctrine has since attracted the attention of Mr. Dalton, and many other eminent chemists.—Many hypothetical views have been blended with this doctrine of definite proportions, or the atomic theory, as it has been called; but it is better to omit these, and consider only the facts. It is, perhaps, illustrated better by the gases than by any other substances. Thus, one volume of hydrogen unites to half its volume of oxygen; and as the specific gravity of hydrogen is 1, and that of oxygen 15, the one volume of hydrogen has a specific gravity of 1.0, while the oxygen it unites with has a specific gravity of 7.5. The volume of hydrogen then is twice as great as the volume of oxygen, with which it unites to form water, while the oxygen is $7\frac{1}{2}$ as heavy. It is thus represented:—



Hydrogen 1 part, and 33.5 by weight of chlorine, form muriatic acid gas; and as the specific gravities of these two substances are as 1 to 33.5, they unite in equal volumes. Nitrogen and oxygen unite in four proportions: the first bears the relation of 1 nitrogen to $\frac{1}{2}$ oyxgen; the second combination is a multiple of the first, or 1 nitrogen and 1 oxygen; while the third combination is 1 nitrogen and 2 oxygen; and the fourth, 1 nitrogen and $2\frac{1}{2}$ oxygen. Thus, bodies not only unite in definite proportions in the first compound; but any second compound they form is an exact multiple or division of the first. 100 parts of lead combine with 4 of oxygen to form the first oxide, with 8 to form a second oxide, and with 12 to form a third oxide. 100 of copper unites with 12.5 part of oxygen to form one oxide, and with 25 parts of oxygen to form a second. Carbonic acid and potassa unite in two proportions; in the one 70 parts of potassa are combined with 32 of carbonic acid, and in the other 64. Thirty-two parts of this second may be driven off by heat, and no more. There are no intermediate compounds of these two substances. In the case of the three oxides of lead, the second is a mixture of the two others, and not a perfect compound. Some bodies appear to combine in any proportion: salt and water, for example; but there is a point when the water will take up no more salt, and it may be supposed that between this point and the commencement of the combination, every intermediate combination is definite. When one body will take up no more of another, it is said to be saturated; while the term neutralization means, that state when the peculiar properties of two bodies are mutually destroyed by their mixture. If an acid be added in proper proportion to the vegetable solution which had been changed green in the early part of the lecture, the blue is restored by the acid neutralizing the alkali. If the acid solution be added to the alkaline, there is a certain point where the taste will be neither acid nor alkaline but slightly bitter; the alkali is then neutralized by the acid, and the resulting compound is called a neutral salt. It has been found, as might have been supposed, that there exists a constant proportion between the neutralizing powers of different substances. Thus, 100 parts of sulphuric acid and 68 parts of muriatic acid neutralize 118 of potassa; and when it is also found that 100 parts of sulphuric acid neutralize 71 of

lime, it is inferred that 68 parts of muriatic acid will do the same, which is found to be the case. On this principle of proportion in the neutralizing powers of different substances, Dr. Wollaston has constructed his tables of chemical equivalents, which is of great use in practice. To these tables, also, he has adapted a logometric scale, on the principle of Gunter's scale, which enables the chemist to solve many problems with great ease, which he formerly only got at by a roundabout process. The professor's lecture concluded by an illustration of the analytic and synthetic mode of proof in examining the chemical constitution of bodies.

LONDON CHEMICAL SOCIETY.

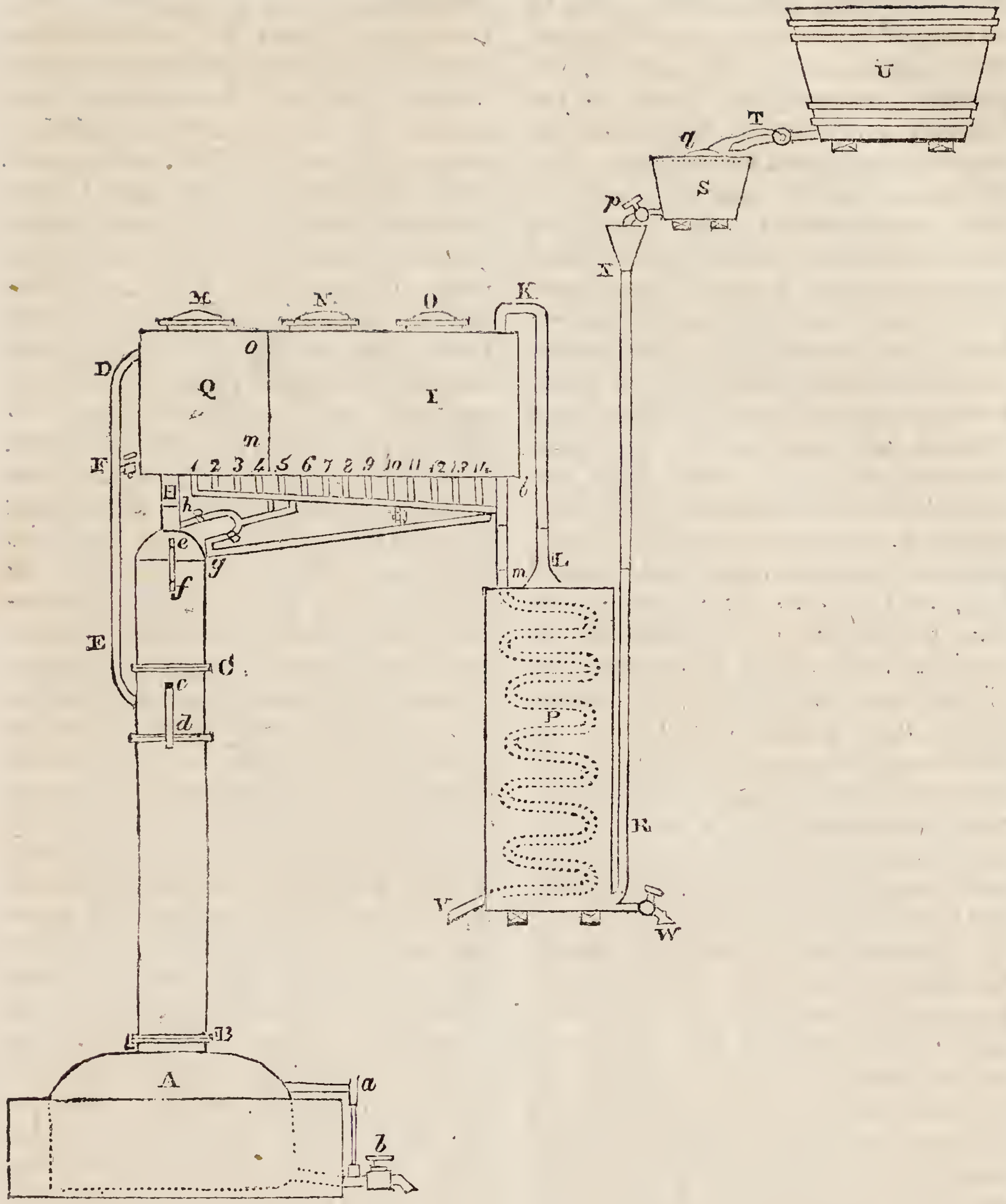
As our efforts were in some measure subservient to the establishment of this Society, it necessarily gives us considerable pleasure to hear of its prosperity. The number of members, we understand, is on the increase, and they are generally young men, who enter it with zeal, and with a wish to profit by all its advantages. On Thursday, October 7th, we attended a Lecture on Heat, delivered by a Mr. Davis in a very pleasing style, agreeably illustrated by experiments. Several ladies were present, taking a warm interest in all that was said, encouraging the lecturer by their smiles, and ensuring order and decorum by their presence. The Society is, we understand, to have an inaugural meeting at the City of London Tavern, on November 9th, at which Dr. Birkbeck, who has been elected president, is to deliver an address.

CHEMICAL SOAP BUBBLES.

Procure a bladder, to which a stop-cock is adapted, having the bowl of a tobacco-pipe fitted into it. Fill the bladder with hydrogen gas, and when full dip the pipe into soap lather, open the stop-cock, and by pressing on the bladder the usual soap bubbles will rise; but instead of being filled with common air and falling to the ground, they are full of hydrogen gas, which being specifically lighter than air, they will rise rapidly. If instead of using hydrogen gas, the gas employed be hydrogen mixed with atmospheric air, and it be blown, by means of a jet pipe affixed to a bladder, into a basin of soap suds, bubbles may be formed over a considerable part of its surface; and by means of a lighted match the whole may be made to explode with a loud report. If two parts of hydrogen gas and one of oxygen gas be used, the bubbles blown with this mixture take fire on the approach of a lighted candle, and detonate violently. They must be completely separated from the pipe before they are set on fire. It is pleasant to find philosophy thus adding to the amusements of youth: and that science must surely be acceptable to all, which comes thus dressed in the gay and flowing garb of pleasure. Milton has certainly had chemistry in his eye when he sang—" How charming is divine philosophy," &c.

SULPHUR IN OIL GAS.

In Paris there is a company for lighting by gas, which uses the oil obtained from the seeds of the *brassica oleracea arvensis*; and it has lately been found that the sulphur contained in this seed was dissolved in the gas, and had a pernicious effect on the neighbourhood where it was consumed. The gas attacked metallic substances, and affected respiration. The brass burners were soon corroded and destroyed, and filled with an efflorescence, which has been analyzed, and shown to be a sulphate of zinc and copper, a sub-sulphate of copper, phosphate of copper, and oxide of iron, with some traces (accidental) of silica. This shows the necessity of washing the gases thoroughly, and of not using these seeds, if the washing does not clean the gas.—*Bulletin des Sciences Technologiques.*



DISTILLATION.
Art. VI.

M. DEROSNE'S METHOD.

(*From the French of M. Dubrunfaut.*)

As this method is at present considered in France as the most perfect mode of distillation, we mean to give a description of it, from a French work on Distillation, lately published. The apparatus consists in, 1st, two caldrons, or coppers; 2dly, a distilling column; 3dly, a rectificator; 4thly, a condensator and wine heater; 5thly, a cooler; 6thly, a reservoir; and 7thly, a vessel containing wine, by which the pressure is regulated. Our plate, for convenience, represents only one copper, and the second may, in point of fact, be dispensed with; but it is better to have two, both for the saving of fuel and to prevent any mischief from the neglect of workmen. The two coppers are to be placed close to one another, and so that the copper A, in our plate, can be discharged into the other, which is not represented. They are both to be surrounded by masonry, to prevent the escape of heat from their surfaces; and the air heated by the first copper may be directed under the second, so as not to waste a particle of heat. The two are to communicate both by a tube passing from the bottom of the second, A, to the upper part of the first, and

provided with a stop-cock; and by a tube, which, arising from the first, not represented in our plate, plunges beneath the liquid in the second, and carries into it all the vapour generated in the first. The second of these coppers only is here represented, and therefore the reader must conceive another placed a little below it, and connected with it by the two tubes we have just mentioned. The centre of the combustion is placed under the first copper, and the flame and heated air pass from it to the other copper. We shall here say nothing about constructing the fire-places for the two, as that is certainly a separate branch of the subject, and has to be regulated on the principle of promoting as perfect and rapid a combustion of the materials employed as possible, and using the whole of the heat thus generated before the other products of the combustion escape into the air. *a b* is a glass tube, connected with the copper, and intended to show constantly the exact height of the liquid in it. B C is the distilling column, where the separation of the alcohol takes place. Its interior is full of shelves pierced with holes, but so placed as to form a sort of labyrinth, as it were, through which the vapour arising from the second copper must pass in its way upwards, and the wine or liquid to be distilled must also pass in its way downwards, and by which contrivance both are arrested in their progress, and kept long and perfectly in contact with each other. The small tube *c d* shows the state of the column, and is necessary for conducting the work. C C is the rectificator, and is, in fact, only an extension upwards of the column B C, and has the same sort of mechanism as in its interior. The vapours from the distilling column always pass through it, and through the conduit H into the condenser. The glass tube *e f*, connected with the rectificator, in the same manner as the tube *a b* is with the copper, always shows the movement of the liquid in the rectificator. The condenser Q I is a copper cylinder, calculated both to condense the vapours and to heat the wine which is to be distilled. It contains, connected by H with the rectifier, a serpentine coiled horizontally, each bend of which at its lower part communicates by a separate tube, marked 1, 2, 3, &c. with the conduits *h j* and *g j*; and the spirit passes out of this either wholly condensed, or before being so, by one of the small tubes, or by the conduit *h m*. There are cocks to these tubes to draw off the spirit, if it is so required; and the tubes *h j* and *j g* are so constructed, that the spirit drawn into them from the condenser may, if required, be again carried back to the rectificator. The condenser is divided by the partition *n o* into two unequal parts, Q and I, and the only communication between these two parts is at the bottom of *n o*. M N O are three openings of the condenser, each of of which is closed by a lid, and by their means the inside of this part of the apparatus may be cleaned when necessary, the cock F serving to draw off the wine. Into this condenser the wine arrives constantly by the tube K L, and as constantly flows off by the tube D E. P is the cooler, also a copper cylinder, which receives the wine at its lower part by the tube X R, and sends it by the tube K L, from its upper part, to the condenser Q I. It contains a serpentine, which receives the condensed vapours by the tube *l m*, and delivers the cooled product at the opening V. W is a cock serving to empty the cooler. S is the reservoir which contains the wine; it has a cock *p*, by the opening of which the quantity of wine to be supplied to the apparatus in any given time can be exactly regulated; and in order that this may be equal, the pressure is also regulated by means of the liquid in U. Into it the wine may be conveyed by a pump, or any other convenient method. It is provided with a cock T, connected with the hollow floater *q* in the reservoir S, which, rising and falling with the

liquid in it, turns the cock T, and thus regulates the quantity of the liquid in S, and consequently the pressure.

THE MODE OF CONDUCTING THE DISTILLATION by this apparatus is as follows:—The liquid to be distilled is put into U,—in France this is principally wine,—from which it passes into the two coppers to the height the distiller pleases, which is known by the glass gauges. The distilling column is then charged with as much wine as will prevent a free passage of the vapour; and when the condenser and cooler are also full, the entrance of the wine is stopped, and the communication is not re-established, by means of the cock *p*, till the wine of the coppers has parted with its alcohol, and the liquid in the condenser is hot enough to be introduced into the distilling column. After this a small stream, in proportion to the size of the apparatus and the rapidity of the work, is constantly kept running from S, and now begins what is, properly speaking, the continued process, all the previous work being only preparatory. After this period, the supply of the vessels with wine, the distillation of the spirit, its condensing and cooling, go on of themselves, only requiring the fire under the first copper to be kept constantly burning, the liquid in it to be occasionally drawn off, and the vessel placed under the cooler to be large enough to receive all the products.

THE PRINCIPLES OF OPERATION are thus described:—There are two distinct parts of the apparatus: one, that in which the vapour is in direct contact, or mixes, with the boiling wine, or boiling small wines; the other, that in which the vapours are in the serpentines, and not in direct contact with the wine, to which they nevertheless communicate heat as they condense. The distilling column and the rectificator constitute the first part, the other is composed of the condenser and the cooler. It will be recollected, that by far the larger half of all liquids which are distilled consists of water; and the first principle of the apparatus seems to be, that, though nothing but wine enters the coppers, nothing but water is ever to be found in them. This is the chief use of a double copper. The wine, it will be observed, in its progress to the coppers, is, in fact, distilled by the vapours arising from them, so that when it reaches the second of them it has already lost the greater part, or the whole of its alcohol. It is there, however, subjected to the action of the vapours from the first copper, which effectually separates all the spirit. This liquid is conducted by the tube of communication into the first copper, where, of course, it is boiled, which, did it still contain alcohol, would separate it. Care is, however, taken not to open the cock of the tube which connects the second copper with the first, immediately after it has received a fresh supply of liquid. The great use of the glass tube gauges attached to each copper is to point out when they contain so much liquid as to make it necessary to draw off a portion, which is then done. In point of fact, then, the liquid which boils in the copper is water. Now, when this reaches the temperature of 212 it passes into vapour, and occupies a space more than 1700 times greater than it occupies as water. But alcohol, when pure, passes into vapour at the temperature of 173°, and consequently its vapour contains much less heat than the vapour of water. It is on this principle that the separation of the water from the alcohol in distillation reposes. The vapour of the water at 212, as it ascends in the column, meets with alcohol at 173, or much colder than it; and, in consequence of the tendency there is to an equal distribution of heat among all bodies, parts with its heat and condenses, while the alcohol, taking this heat, is vaporized.—Now, if the vapour which passes into boiling wine be a mixture of water and spirit, the vapour of the spirit will pass through the boiling

wine without any change, while the portion of vapour of water will give out its heat to the alcohol, will be condensed, and by its condensation will produce a relative quantity of alcoholic vapours. The column in which this separation takes place may be considered as a number of small coppers containing boiling wine. The vapours are rich in alcohol, and meet with a wine also rich in spirit, in proportion as they reach the upper parts. In the machine invented by Adam the wine to be distilled has first been enriched with the alcohol from the first still, while in this apparatus it is the alcoholic vapours, as they arise, which are continually enriched by passing through heated and almost boiling wine. The same thing takes place in the rectificator. The already distilled spirit, or small wines, which enters it from the condenser, rich in alcohol, are again distilled; the alcoholic vapour passing into the condenser, and the water separating and falling; so that both in the rectificator and in the column the descending liquid constantly parts with spirit in its progress downwards, and the ascending vapours constantly acquire it and become more alcoholic. The alcoholic vapour passing into the condenser, and no longer in contact with wine, is increased in strength by a somewhat different principle. Till it reaches the condenser it is constantly taking spirit from fresh wine, and in it the water or small wines condense sooner than the alcohol, separating from it and falling back, while the vapour passes on; and consequently it is found that the spirit has a different degree of strength at every turn of the serpentine in the condenser, increasing as it proceeds from the rectificator. The mode in which the serpentine is coiled permits the spirit to be drawn off at any one bend, conducted into the cooler or into the rectificator, and thus by the same process spirit of any strength may be obtained.

The expense of an apparatus of this description, capable of distilling from 10 to 12,000 *litres* of wine in 24 hours, (say between 2600 and 3000 gallons) is charged for at Paris, by M. Derosne, at the rate of 5000 francs, or somewhat more than 200*l.* sterling. Its advantages, as proved by several trials, over the most approved form of Adam's and Berard's apparatus, are said to be very great. The result of several trials, in the presence of competent judges, was, that with the latter apparatus the proportionate profit was 6 *francs* 53 *centimes*, while with M. Derosne's it was 26 *francs* 52 *centimes*, making it four times more profitable than the most advantageous apparatus hitherto employed. The advantage arises from two causes—first, the greater quantity of spirit obtained by M. Derosne's method in proportion to the wine employed, which amounts to a 100th part; and, secondly, the less quantity of labour necessary. It will be seen, from the description of the apparatus, that after being erected, one man may look after more than one complete apparatus, and, except for the cleaning, &c., hardly any labour is requisite by this continued method of distillation. The latter circumstance should make this method peculiarly advantageous in our country. It may also, we understand, be connected with some other operations besides distillation, so that the heat which is wasted by heating all that portion of the liquid constantly drawn off from the boiler may be applied to several useful purposes, making this apparatus by far the most economical that has ever been applied to distillation. M. Derosne, in conjunction with an English gentleman of considerable scientific skill and reputation, has taken out a patent for his apparatus; but we understand that the excise laws oppose at present insurmountable obstacles to its being adopted in practice.

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DICTIONARY OF CHEMISTRY.

Chrysoberyl, the *cymophane of Haüy*. A very hard mineral found in Ceylon, Connecticut, and Siberia, and consisting of alumina 71, silica 18, lime 6, and oxide of iron 1 and a half.

Chrysolite, the *peridot of Haüy*. The topaz of the ancients, and the least hard of all the gems. It is found in Egypt and Bohemia. It consists of silica 39, magnesia 48.5, oxide of iron 19.

Chrysoprase. A variety of calcedony. It has only been found at Kosemütz in Silesia. It is used in jewellery. Its constituents are said to be 96.10 silica, 0.08 alumina, 0.83 lime, 0.08 oxide of iron, and 1 oxide of nickel.

Churning. The agitating process by which the oily part of milk is separated from the watery part. Though the action is mechanical, the principle of the separation is chemical.

Chyazic Acid (ferrutted). The name given by M. Porret, the discoverer, to *ferroprussic acid.*

Chyle. A milky substance into which the *chyme* is changed in the intestines, by being mixed with the pancreatic juice and bile. It has a slight sour-sweet taste, and coagulates into curd and serum.

Chyme. The substance into which food is changed in the stomach of animals is called *chyme*. According to the experiments of Dr. Marcet it contains albumen.

Cimolite, *cimolean earth*. The cimolia of Pliny. It was formerly used both in medicine and for cleaning cloth. It consists of silica 63, alumina 23, oxide of iron 1.25, and water 12. It is thought by M. Klaproth to be superior to our best fullers'-earth, with which it has been sometimes confounded. It is found in the island of Argentiera.

Chinchona, *bark*, of which there are three varieties, the red, the yellow, and the pale. The latter is most generally employed as a medicine.

Cinchonina. A vegetable alkali discovered in *cinchona condaminæa* by MM. Pelletier and Caventou. The alkaline base of the yellow bark is called *quinina*. The red bark contains both these alkalies.

Cinnabar, *sulphuret of mercury*. When reduced to powder it is well known under the name of *vermilion*, and is employed as a paint.

Cinnamon. The inner bark of the *laurus cinnamomum*, a tree which grows chiefly in Ceylon. Its properties as a spice are owing entirely to the volatile oil it contains.

Cinnamon Stone. A very rare mineral, of a blood red colour, composed of silica 38.8, alumina 21.2, lime 31.25, oxide of iron 6.5.

Cipolin. A green marble with white zones, brought from Rome and Antium. It contains carbonate of lime 67.8, quartz 25, schistus 8, iron 0.2.

Cistic Oxide. A peculiar animal product, discovered by Dr. Wollaston in urinary calculi, and giving to them peculiar characteristics. It is not often met with.

Citric Acid. An acid found in a variety of fruits, such as limes, lemons, oranges, cranberries, whirtleberries, gooseberries, &c. In some of them it is nearly pure, in others it is mixed with malic acid. It is frequently adulterated in commerce with tartaric acid, which may be detected by adding subcarbonate of potash to the solution. If tartaric acid be present, a white pulverulent precipitate takes place. This acid is an antidote to sea scurvy.

Citrates. Salts formed by the union of citric acid with a base.

Civet. A perfume obtained from the *inguinal* region of the civet cat. Some of these animals have been imported into Holland, and there this substance is squeezed out every other day in summer and twice a week in winter, the quantity procured amounting to two scruples or a drachm. It unites with oils, but is not dissolved by alcohol. Chemists have not yet paid much attention to it.

EFFECTS OF AGE ON TREES.*

It has long been observed and regretted, that several sorts of apples and pears which were once very much prized, are no longer to be met with. Golden pippins, which, in our younger days, were seen on every table, and dazzled the youngster's eye as much as they gratified the discriminating tooth of age, are now rarely or never seen, and are worth almost their weight in silver. The wrinkled nonpareil also, which required you to eat it before you could possibly believe it was equal to a vile crab, and then you blamed, as most unjust, the hasty decision which condemned it for its outside, seems also quite extinct. Other apples that were formerly common are now lost, and larger and more showy fruit, which seems not native to our soil, has supplied their place. This change has been too often remarked to leave any doubt of it. "The fact," says Mr. Knight, "that certain varieties of some species of fruits which have been long cultivated, cannot now be made to grow in the same soils, and under the same mode of management, which was a century ago perfectly successful, is placed beyond the reach of controversy. Every experiment which seemed to afford the slightest prospect of success was tried by myself and others, to propagate the old varieties of the apple and pear, which formerly constituted the orchards of Herefordshire, without a single efficient or healthy tree being obtained; and I believe all attempts to propagate those varieties have, during some years, wholly ceased to be made. I have detailed in the Philosophical Transactions, an account of some experiments, which I repeated, with the hope of being able to ascertain which, amongst the various organs of trees, of aged varieties, first fail to execute their proper functions, and I came to the conclusion, upon the following evidence, that it is the leaf. Having obtained, by layers or cuttings, small plants of several of the most diseased of the old varieties of the apple, these were grafted within a couple of inches of the surface of the soil, with scions of seedlings and luxuriant varieties, and under these circumstances, the roots of the most debilitated and diseased varieties executed their office perfectly well; and were found, upon examination at the end of several years, wholly free from every symptom of disease. This process was reversed, and scions of old varieties were employed as grafts; but into the young growing shoots, which sprang from these, many buds of new and luxuriant varieties were inserted, and in the autumn every natural bud of the old varieties was destroyed. The inserted buds vegetated in the following spring, and by these efficient foliage was given; when every symptom of debility and disease disappeared, and the wood and bark of the most exhausted and diseased varieties now constitute a part of the stems of large apple trees, and present, at the end of thirty years, as much apparent health as other parts of the stems of those trees. From these results I have inferred, that the debility and diseases of such old varieties, arise from the want of a properly prepared circulating fluid; and that when such is given by efficient foliage, the barks of the most debilitated variety possesses the power to occasion the necessary secretions to take place, and the alburnum to execute all its offices.

"It has been urged against the conclusion, that old age is the cause of the debility and decay of those varieties of fruit which have been very long cultivated. That many of the seedling offspring of such varieties are as much diseased as the parents from which they spring, is unquestionable; but this, I conceive, proves nothing more than that diseases are hereditary in the vegetable, as they are in the animal world; and it is scarcely reasonable to expect that a healthy

* Part of a paper of Thomas Andrew Knight, Esq. president of the Horticultural Society.

and robust offspring can be obtained from parents, whose lives have been extended beyond their natural periods, by preternatural means, and whose bodies are yearly falling to pieces under the operations of disease, and in which the whole of the circulating fluids are in a morbid state." We have quoted these observations because they seem to have a practical bearing. If it be correct that the disease, and, we may say, death and destruction of certain sorts of plants arises from the leaves not performing their functions properly, this fact will teach us that we should never, as is now, we believe, very generally the practice, take grafts or buds from old trees.

LECTURES ON CHEMISTRY AT THE MECHANICS' INSTITUTION.

The second lecture of Mr. Cooper was given on Tuesday evening to a large meeting of mechanics. The object of the lecturer was to illustrate the theory of chemical affinity, which he rightly characterized as the base on which the whole superstructure of the scientific part of chemistry is constructed. We shall not pretend to follow Mr. Cooper through the lecture, because it was one continued series of experiments, that cannot well be described without a sketch of his apparatus. The first point Mr. Cooper illustrated, was the effect of chemical affinity on compound bodies, which he described as taking effect without the instrumentality of any other substance, while the union of some elementary substances was not effected without the intervention of some agent. Hydrogen and oxygen, for example, when mixed in the proper proportion for forming water, did not act on each other unless excited by some foreign agent, like electricity; and when so mixed, and an electric spark was transmitted through them, they combined instantly, and water was formed. Some elementary substances again combined without the assistance of any agent; thus powdered antimony, on being thrown into chlorine, caught fire, and a union immediately took place. Decomposition, as well as union, was also the result of affinity. A piece of the metal potassium thrown on water decomposes it, in consequence of the great affinity which this metal has for oxygen, while the hydrogen gas, the other constituent of water, is set at liberty, and catches fire. This experiment, which is a very beautiful one, was exhibited to the admiring spectators. By virtue of the same law of affinity, potassium also decomposed carbonic acid gas, proving this to be a compound of oxygen and carbon. Mr. Cooper pointed out, at every one of his numerous experiments, that bodies only combined in certain definite proportions; and that if more oxygen were present, for example, when carbon was burnt than was necessary to form carbonic acid, a part of it would escape; while if more carbon were present, a part of it would remain unconsumed. The important law of bodies only combining in definite proportions was very properly dwelt on, and the lecturer also stated the basis of what is called the atomic theory, or equivalent numbers, recommending strongly to his hearers to procure Dr. Wollaston's logometric scale. Equivalent numbers signify the specific gravities of any bodies which combine together, by comparing a volume of them with an equal volume of hydrogen. Thus the specific gravity of oxygen, the lecturer said, was 16, that of hydrogen 1; half a volume of oxygen combining with one volume of hydrogen to form water, the former was represented by 8, the latter by 1, and the compound by 9. Mr. Cooper's lectures are full of matter and rich in illustrations and pleasing experiments. He only needs a little more method and a little more facility, both of which he will gradually acquire, to be an excellent lecturer; and we are quite sure the members of the Mechanics'

Institution will derive both pleasure and instruction from the continuance of his course.

NATIVE OIL OF LAUREL.

Dr. Hancock has published, in the Quarterly Journal of Science, No. 35, an account of a volatile oil obtained from a tree of the laurineæ family, which abounds in the fertile regions between the Orinoco and the Panine, in America. It is procured by striking into the tree with an axe, and as it is not distributed equally in every part, some skill is necessary to find out the proper spot. The native oil resembles the essential oil obtained by art in many of its properties, but is purer. It is very volatile, and very little heavier than alcohol. Its elaboration in the plant is a curious fact, and may lead to some interesting researches and discoveries in vegetable physiology.

FUMIGATING MIXTURE.

Mr. Faraday was employed some months back, to superintend the fumigation of the Penitentiary at Millbank, and the materials he employed were the following:—One part by weight of common salt and one part of the oxide of manganese, when acted on by two parts of oil of vitriol, previously mixed with one part (by weight) of water, and left till cold, produced the best results. Such a mixture, at the temperature of 60 Fahr., liberated no muriatic acid, but in a few minutes began to evolve chlorine, and continued to do so for four days. When examined on the fifth day, and urged by heat, so as to cause the liberation of all the chlorine it could supply, only a small proportion was obtained. Such a mixture, therefore, may be considered as liberating its chlorine gradually but completely without the application of heat, and to be proper for fumigating. Common red pans were used at the Penitentiary. The salt was reduced to powder, and then the manganese was added, and the whole well mixed. The water was put into a tub, and about half the acid added, and the mixture stirred. When the heat had dissipated, which was in a few hours, the rest of the acid was added, the mixture stirred as before, and then left to cool. About $3\frac{1}{8}$lbs. of the salt and manganese were put in each pan, and when all the pans had been arranged, the holes all carefully closed, the diluted acid, in the proportion of $4\frac{1}{2}$lb. to each pan, was poured in, the mixture stirred, and then, the doors being closed, it was left to itself. In a few minutes the general diffusion of the chlorine was quite evident. Each pan yielded 1lb. of chlorine, or $5\frac{1}{2}$ cubic feet: 700lb. of common salt, 700lb. oxide of manganese, and 1400lb. of oil of vitriol were employed. The space requiring fumigation amounted to about 2,000,000 cubic feet, and the surface of the walls, floors, ceilings, &c. 1,200,000.

PRESERVING STUFFED BIRDS.

Mr. Temmick, Director of the Dutch Museum, has for many years made use of no other means of saving stuffed birds and quadrupeds from the attacks of minute insects than placing a small wooden basin, containing tallow, in each case, which he finds more effectual than either camphor or Russia leather.

QUERY.

The method of preparing a transparent tracing paper, so that it will take water colours equal to that which is not prepared?

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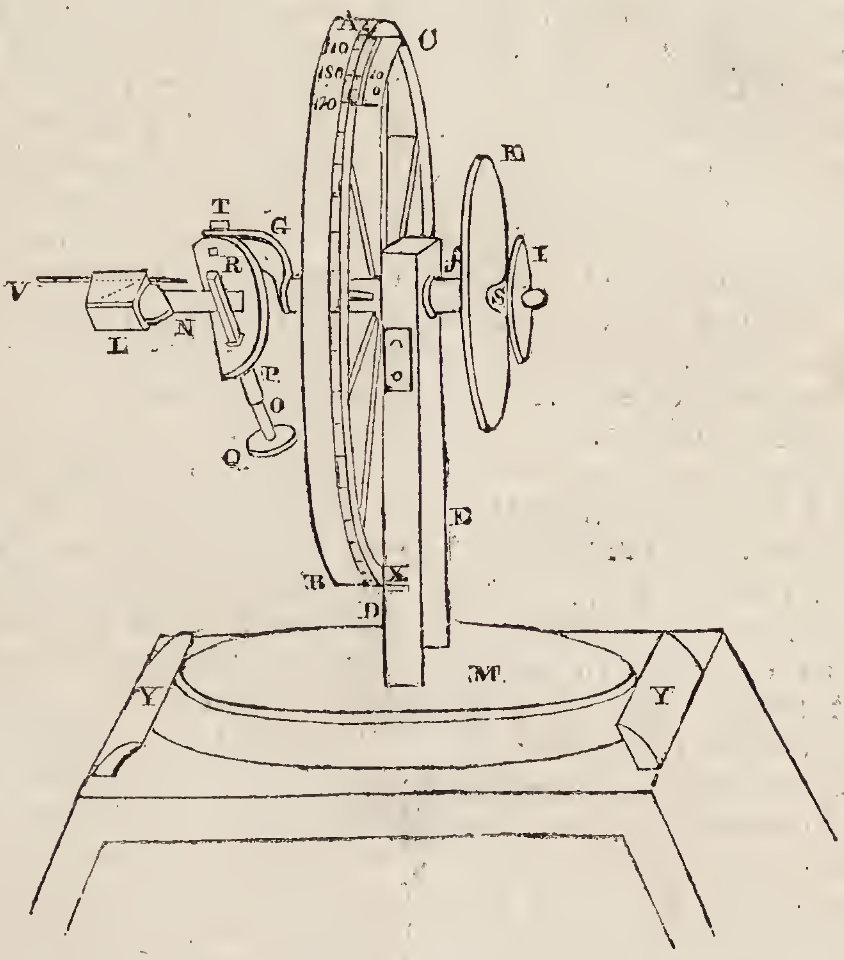

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DR. WOLLASTON'S GONIOMETER.

We borrow a description of this instrument from Mr. W. Phillips's Introduction to Mineralogy. A B is the principal circle, graduated on one edge to half degrees, and divided, for convenience, into two parts of 180° each. In the above sketch it is only graduated in part. C is a brass plate screwed upon and supported by the pillar D, and graduated as a vernier. *f* is the axle of the circle AD, and passes through the upper part of the two pillars D E, the other ends of which are inserted into a wooden base M. G H is an axle inclosed within *f*, and turned by means of the smallest circle I, which communicates a motion to all the apparatus on the left of H, without moving the principal circle A B. K is a circle, to which is attached the axis of the principal circle. If, therefore, we move the latter, it will be done by moving K; and as the axle of the principal circle includes that of the appara-

tus on the left of H, we necessarily give a motion to the whole instrument by moving the circle K. We despair of being able, within any reasonable compass, to make our readers acquainted with the mode of using this instrument, which depends for its utility on the power of the polish on the natural fractured surfaces of the mineral, which is very considerable. We must merely observe, that it is intended to measure the angles of crystals, which it does very correctly, by reflecting the rays of light from the surfaces of the crystals. To those of our readers who desire to prosecute the study of crystallization, we must recommend an inspection of the instrument, and to see it used by some practised person.

LECTURES ON CHEMISTRY AT THE ROYAL INSTITUTION.*

Heat, Mr. Brande said, in his fourth lecture, may in general be considered as opposed to attraction, for it tends constantly to make the particles of matter separate from each other. It changes the bulk and form of bodies. Expansion is one of the most general and obvious effects of heat; but all bodies are not equally extended by the same degrees of thermometric heat. Gases are expanded most, and solids least. As solids are expanded by heat and contracted by cold, this fact has furnished natural philosophers with the strongest argument they can urge, that the particles of bodies are not in contact. In their cooling or heating there is some interstitial matter separated or added. The expansion occasioned by heat is not permanent, but the body so expanded, on being cooled down to its former temperature, contracts to its original size. It is a question of some importance to ascertain how far different bodies are equally expanded by equal quantities of heat; and it is found that there is a great difference in all bodies: the metals, for example, expand more than glass, and some metals expand more than others. Thus, 120,000 parts of platinum expand, on being heated from the freezing to the boiling point of water, 104 parts, steel 147 parts, iron 151 parts, copper 204 parts, brass 230 parts, tin 290 parts, lead 345 parts, and zinc 360 parts. The machine for measuring the expansibility of these metals consists in a quadrant, the index of which is acted on by a long lever touching the end of the metal to be measured. A rod of the metal, divided into 120,000 equal parts, is to be placed in the instrument, first cooled down to the temperature of ice, and then heated up to the temperature of boiling water. The larger space it occupies at the latter point than at the former, shows its expansibility. Liquids as well as metals differ in their expansibility, and those which have their boiling point lowest in the scale are generally most expansive and contractile. Ether and spirit of wine have their boiling point low, and expand more than mercury, the boiling point of which is high. It has been satisfactorily proved of all gases, air, and vapour, that they expand equably and equally with the same increments of temperature. Between the boiling and freezing points, 100 parts of air will expand 37½ parts, and the rates of its expansion with every addition of heat are equal. Solids, it appears, do not expand equably with every increment of temperature, but the experiments on this subject are not very satisfactory. The expansive powers of liquids are very unequal at different degrees: alcohol, for example, expands much more by an additional degree of heat as it approaches the boiling point. Those liquids are most equably expansive the boiling points of which are highest. This is one

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* Our wish to give in one Number the substance of all which Mr. Brande has delivered on Heat, has made us extend the present Article, so as to include four lectures. There are three lectures per week at the Royal Institution; and last week, in order to give in one Number all which relates to Heat, we purposely abstained from giving the third lecture.

circumstance which makes mercury answer well for thermometers. Heat is conducted through solids. The part or strata next the source of heat is first heated, and communicates its heat to the next strata; but in liquids the particles change their places, and those which are heated rise to the top. By heating water containing any insoluble powder, it will be seen that there is, while the heat is applied to the lower part of the vessel, two currents, one ascending and the other descending. Thus, heat applied to the top of liquids only heats the surface. The particles of air are still more mobile than those of water, and thus change their places, when heated or cooled, still more easily. The crooked appearance of objects seen through heated air arising from a chimney when there is no smoke, is a proof of its being more rarefied than the circumambient medium. The air over a fallow field caused also, in summer and dry weather, very often the same appearances, arising from being more heated than the surrounding air. It is on the principle of air being expanded by heat, that rooms are ventilated; but if care be not taken to make the ventilating funnel pass through a fire, or steam pipes, or if it be not provided with a lamp beneath, there is very often a cold current of air falling down like a shower, while the heated air ascends. In the theatre of Covent Garden the glass chandelier, with its numerous gas burners, giving out a great quantity of heat, being placed immediately under a large funnel, which passes through the roof into the open air, answers the purpose of ventilation extremely well. Its own heat and smoke pass off, and also carry away a large portion of the foul air of the house. There is considerable difficulty in preserving an equal degree of heat in a well ventilated theatre or room. —The different number of persons assembled in it, with the different temperature outside, does not allow the temperature within to be so equally regulated. The thermometer may be kept, indeed, within 50 and 70, but 20 is a wide range. People who attempted to convey heated air into apartments generally failed, by heating it too much, and not heating enough of it. After the principle of introducing the heated air at the lower part of the apartments, there was nothing more necessary than not to heat the air too hot, and to take care and send in a large supply. It should not be heated very much above the required temperature. The professor then noticed the circumstance of water not expanding by heat within a certain range of the thermometer, which he contended is the only exception to the general law of all bodies expanding by heat. The apparent expansion of certain salts in solution when they crystallize, of certain metals, iron, for example,—which the professor described as first expanding so as to fill the mould, and then contracting,—is owing to a new arrangement of their particles. The same thing takes place with ice, and this polarity of the particles of matter is of such power as to burst not only glass, but iron vessels. After explaining on these principles the apparent exceptions to the law of bodies expanding by heat, he went on more particularly to illustrate the fact of water obtaining its greatest density about 40°, and its important consequences. The mean temperature of the earth is about 55°, and water is cooled down below that by the air carrying off heat from the surface. When the surface is cooled it sinks till the whole mass of the water is cooled to 40°, but then the upper stratum of water, as it is cooled still further, expands, and becoming specifically lighter than the remainder of the water, swims on the top. Ice, also, is much lighter than water, in the proportion of 94.6 to 100, so that ice as well as the colder water remains uppermost. Ice is a bad conducter of heat, and if it be broke in winter the water beneath it will be found at the temperature of 40°. This is the

temperature congenial to fish, and thus they live through the severest winters. In large quantities of water the ice breaks or rifts, and by this means fishes are supplied with air; but in small fish ponds it is necessary to break the ice, that they may receive the requisite supply. This anomaly of water was first observed by the Florentine Academicians, who accounted for it by supposing the glass contracted when exposed to cold, but who discovered their mistake on finding that alcohol did not expand in the same manner when the glass bulbs in which it was contained were exposed to cold. Hence the fact became known, that below the fortieth degree water expands as it is cooled, and the utility of this anomaly is now as evident as the fact.

Having explained in the fourth lecture the effect of heat in expanding bodies, Mr. Brande proceeded, in his fifth lecture, to observe, that the expansion of metals is of great importance as applied to instruments for measuring time. Both the metallic pendulums of clocks, and the balance-wheels of watches, are affected by changes in temperature, and will not keep time correctly unless this varying effect is constantly balanced or counteracted. In the latitude of London, at the temperature of 60°, a pendulum thirty-nine inches and 38,000 parts of an inch in length vibrates seconds; when the temperature is less than 60, this pendulum shortens and vibrates quicker, while it is lengthened and vibrates slower if the temperature is increased. Some efforts have been made to find substances for pendulums which are not, like metals, affected by change of temperature, and a piece of dry fir answers pretty well. As this substance is not, on many other accounts, so good for this purpose as the metals, very ingenious means have been fallen on to compensate their expansion and contraction, and applied both to watches and clocks. Pendulum rods have been constructed of two metals of very different degrees of expansibility; and wheels of watches have also been so constructed. One sort of a compensation pendulum (it was exhibited by Mr. Brande) is constructed by means of two bars, one of brass the other of steel, riveted together. The brass being much more expansible than the steel, on any change of temperature the bar is curved, and forms a segment of a circle, having, if the temperature rises, the steel on the inside, and if it falls, on the outside. Two such bars are placed in a horizontal direction, so that any alteration in their curvature alters the vibrating point, shortening the pendulum when the temperature rises, and lengthening it when the temperature falls. Numerous experiments and accurate calculations are of course necessary to adapt these two effects nicely to one another, but they belong rather to the mechanician than the chemist, and the example is only quoted to show the great importance to the arts of the expansibility of the metals. Thermometers have been constructed out of solid metals, but they have not answered. Another use to which the lengthening or shortening of metals by change of temperature is put, is to bind things tight. The wheelwright, the cooper, and the mast-maker all heat bands or hoops before they apply them, and then the contraction of the metal keeps all secure.

The professor then described the mode of constructing thermometers. It is not certain, he said, who first invented a thermometer; but in general the honour is ascribed to Sanctorius. He certainly used the thermometer which bears his name, but the instrument was not of much value till it was improved by the Florentine academicians in the 17th century; and after this period thermometers were long sold, in every part of Europe, under the name of Florentine glasses. The great modern improvement in thermometers consists in graduating them on a fixed principle, and between two known and fixed points, so that they all

speak the same language, or can be compared with one another. The manufacture of thermometers is at present chiefly in the hands of Italians, who are not over nice in their work. The bores of the thermometer tubes are seldom of an equal diameter throughout; and little care is taken to graduate the scale accordingly. For very high or low temperatures the scale is seldom properly divided: common thermometers are not, therefore, to be relied on; and to have one that can be trusted, care must be taken to make it. Mr. Brande then showed the spectators the mode of filling the thermometer tubes, either with mercury or spirits of wine. For measuring very low temperatures, the best thermometer is made of spirits of wine or alcohol, which has never yet been frozen; and for high temperatures, the common mercurial thermometer is employed. There have been different modes of graduating thermometers; and at present there are three different ones in use in Europe. They all make the two fixed points of the scale the freezing and boiling of water, which always take place at the same temperature under the same atmospheric pressure. The intermediate part of the scale between these two points may be divided into any number of degrees; and the graduations between these points are easily transferred beyond them. Among the different nations of Europe there are three modes of dividing the space between the freezing and boiling points of water. In England Fahrenheit's scale is adopted; and though it is not so simple as the *centigrade* scale, long custom, and the advantage it possesses of being more subdivided than the others, causes it to be continued in use here. In this (as all the readers of the Chemist know) the freezing point is marked 32, and the boiling point 212, consequently the space between these two points is divided into 180 degrees. In France and Germany, the *centigrade* thermometer, called also after Celsius, its inventor, is used. In this the distance between the two points is divided into 100 degrees, and freezing is marked 0, and the boiling 100. In Italy, Reaumur's scale is still used: in it the freezing is called 0, and the boiling 80. There is also another division, that of de Lisle, in which the boiling point is 0, and the freezing point 150. This is not much in use. To reduce the degrees of these scales into one another, we have the following rules: To reduce Fahrenheit to Reaumur, subtract 32, multiply by 4, and divide by 9. Thus, Fahr. $68 - 32 = 36 \times 4 = 144 \div 9 = 16$. To reverse this order, we multiply by 9, divide by 4, and add 32. Thus, Reaumur. $16 \times 9 = 144 \div 4 = 36 + 32 = 68$. To reduce Fahrenheit to the *centigrade*, subtract 32, multiply by 5, and divide by 9. Thus, Fahr. $212 - 32 = 180 \times 5 = 900 \div 9 =$ Cent. 100. For the reverse, we must multiply by 9, divide by 5, and add 32. Thus, Cent. $100 \times 9 = 900 \div 5 = 180 + 32 =$ Fahr. 212. To measure very high temperature, recourse has been had to pyrometers, and that of Mr. Wedgewood, made of pieces of clay, for a long time bore a very considerable reputation; but the experiments of Sir James Hall having shown that the contraction of clays is as great at a low temperature, continued for some time under great pressure, as at a high temperature, this instrument is not now much relied on. The equal but great expansibility of air, makes it answer for very delicate thermometers, and with it Mr. Leslie has constructed his differential thermometer. The advantage of this instrument is, that general changes of temperature do not affect it; and thus it serves to measure any decrease or increase of temperature in a small space.

Specific heat, to which the professor next proceeded, he described to be that quantity of heat which bodies require to raise them to the same thermometric tempe-

rature; and those bodies which require most heat are said to have the greatest capacity for, or greatest specific heat. Dr Black was the first person to show that the heat of different bodies, though they show the same temperature, is different. A pint of water at 100°, mixed with a pint of water at 50°, makes the thermometer rise to 75°; but by mixing a pint of mercury at 100°, with a pint of water at 50°, the resulting temperature is not 75° but 70°: the capacity of mercury for heat is, therefore, less than water. In ascertaining the specific heat of bodies, water is made use of as the standard, and is unit or 1. It is found, that the capacity of bodies for heat has some relation to the rate of their heating and cooling,—those bodies which have the greatest capacity being in general heated or cooled slower than others. If equal quantities of water and quicksilver, for example, be exposed to an equal degree, first of heat and then of cold, it is found that the metal both heats and cools quicker than the water. A great many experiments have been made on the specific heat of bodies; but those made with the calorimeter, in which the quantity of ice melted by a body in cooling is the measure of its specific heat, are not susceptible of much accuracy, from its being impossible to separate the water from the ice, as shown by Mr. Wedgewood. The capacity of the gases for heat varies with the nature of the gas and its density; and their specific heat is altered by their dilatation or compression. By dilatation gases produce cold, and by compression heat, and with every such change their specific heat is altered.

In resuming the subject of heat in his sixth lecture, Mr. Brande reminded his hearers of the conclusion of the last lecture; and then went on to observe, that the thermometer sinks several degrees when placed in an air-pump and the air is exhausted, and rises to its former temperature on the air being readmitted. The rarefaction of air produces cold, and its condensation heat. This property of air is not without its effects in modifying the temperature of the atmosphere, which, as it is warmed by contact of the earth, grows specifically lighter, and rises to the upper regions. The pressure of the superincumbent atmosphere gradually lessens, the warm air grows more attenuated, cold is produced, and the vapours it has carried up with it from the earth assume the solid form and are deposited as rain or snow on the mountain tops. The capacity of bodies for heat, however great, has no effect on temperature, or is never indicated by the thermometer.—Heat passes through some bodies in a very different ratio from others; and this property is called the conducting power of bodies.* Thus, a piece of iron and a piece of glass, one of the ends of which are put into a flame, are found to be heated at the other end in very different times. The iron conducts the heat quicker than the glass, and attains the same temperature throughout in a much shorter space than the glass. Of all bodies metals are, perhaps, the best conductors of heat, but they all differ in their conducting power. This may be easily proved by placing small rods of the different metals, of the same thickness and length, over a brazier, so that the end of each may be at an equal distance from the edge of the brazier, and it will then be found, if the ends be coated with wax, that the wax will melt sooner on some metals than on

* It may be necessary to explain to some of the readers of the Chemist, that the conducting power of bodies, as applied to heat, is that by which the heat is successively transmitted through the body, without the particles of it changing their relative situation; while the carrying power, as evinced in liquids, arises from the portions of the liquid as they are heated changing their place, and thus diffusing the heat equally through the fluid. As the consequence of the application of heat is to make the portion of the liquid receiving it specifically lighter, it is plain that the carrying power can only be exercised when the heat is applied to the bottom of the liquid.

others, their conducting power being in the following order:—Silver, Gold, Copper, Tin, Lead, Steel, Iron, Platinum. The latter, in particular, is found to be a very bad conductor. After the metals, perhaps, the precious stones, as the diamond, and then the topaz, are the best conductors; and then, perhaps, comes glass. Air, whenever it is confined, so that it cannot change its place, is a very bad conductor; and thus it is found by experience, that all porous bodies are bad conductors, the interstitial air preventing the transmission of heat. The conducting power of different substances is not only curious as a natural phenomenon, but of great use in its practical application, the fitness of several substances for clothing and various other purposes depending on their heat-conducting powers. Wood is a bad conductor, and we find it used to make handles for metallic vessels, that may thus be easily managed, when it would not be possible to touch a metal handle of much greater length. Down and feathers are very bad conductors. On this subject Count Rumford made several curious and interesting experiments, which are recorded in the Philsophical Transactions. To ascertain the conducting power of substances, they may be wrapped round the bulb of a thermometer, and either the mercury may be heated, and the time noted which is required to cool it to any specific degree, while encased by different substances; or the thermometer may be exposed to a higher temperature, and the time noted which is requisite to raise it to a specific point. Count Rumford found that a thermometer, inclosed in a tube and bulb of the same shape, but an inch larger in every direction, required 576 seconds to cool down 135°; when 16 grains of lint were diffused through the space inclosed round the thermometer, it required 1032 seconds; and with the same weight of eider down it required 1305 seconds. When 32 grains of eider down were inclosed in the same space, the time required to cool the thermometer was 1472 seconds; and with 64 grains it was 1615 seconds.

The texture of the same substance has also a very considerable effect. It is found that equal weights of raw silk, ravellings of white taffeta, and common sewing silk, the latter being the most twisted, and the hardest, detained the heat, respectively, 1284, 1169, 917 seconds. Thus, also, it is seen, that as the materials are differently compressed, their conducting power is different. It is when substances are of a low conducting power that they are well adapted for winter clothing; and on the above principle the fact is explained of loosely woven and somewhat coarse woollens being warmer than others. From some experiments of Count Rumford, he concluded that liquids do not conduct heat; but later experiments, made with every precaution, by Mr. Murray and Dr. Hope, have demonstrated that liquids do conduct heat. They have found, that when a liquid was heated at the top, it was gradually, though very slowly, heated throughout; and this could not be owing to their carrying power, as the hottest strata would always remain uppermost, from its less specific gravity. Air is a still worse conductor than liquids, and perhaps does not at all conduct heat. Count Rumford first called this principle into use in constructing double doors and walls to furnaces, in which it was the object to retain the heat as much as possible. On the same principle, it is found that double windows add much to the warmth of a room. Ice-houses, also, are constructed with double walls, so that they are completely inclosed by immovable air. Our sensations of heat and cold, also, are referable to the conducting power of bodies; thus a piece of metal feels cold compared with a piece of wood, and we dare not touch some metals in cold weather, when we can freely handle other substances which do not differ in their effects on the thermometer, or show the same temperature as the metals. When we are exposed to the air, that cools us more by its carrying than

conducting power, as we are constantly exposed to different portions of air; and thus it is found that air in motion, or a strong wind, cools more effectually than air at rest. A curious exemplification of the conducting power of different substances may be obtained by covering a cylinder or bar of wood, and a cylinder of metal, with a piece of writing-paper, and exposing the paper to the flame of a lamp. The metal within it conducts the heat away so rapidly, that the paper is not even singed; while with the wood it is instantly singed, and would burn in a short time. This experiment was made, and the paper round the metal cylinder held for a considerable time in the flame of a spirit lamp, and it was not even singed.

Heat effects a change of state in bodies. To take a familiar example, the solid ice is converted by heat into water, and, by a still greater quantity of heat, into vapour or steam. It is probable that all substances may, by heat or cold, be made to assume the state either of a gas, a liquid, or a solid. During the liquefaction of solids, or the conversion of liquids into gases, a quantity of heat is absorbed, which is not indicated by the thermometer. Heat, for example, added to ice at 32°, does not change its temperature till after the whole of the ice be converted into water. A pound of water at 32° and a pound of water at 212°, mixed together, produce a mean temperature of 122°; but a pound of ice at 32° and a pound of water at 212° only produce, after the liquefaction of the ice, a temperature of 52°. Thus a quantity of heat capable of raising the thermometer 140° is absorbed by the ice in its change into water. Dr. Black was the first person to investigate and explain this curious phenomenon; and he attributed the disappearance of the heat to its becoming latent in the ice, or combining with it; and using this language, therefore, water is a compound of ice and a certain quantity of heat. The same fact is true of all bodies which change their state; and solids in liquefying absorb heat, which becomes insensible or latent, and liquids, when they become solid, give out this latent heat. The same fact is true of gases converted into liquids, or liquids converted into gases. Many natural phenomena are explained on this principle. As there are a great many solid substances which have a tendency to unite, and form a liquid, they answer very well for producing a great degree of cold. They are called freezing mixtures. The substances should be crystallized and recently reduced to fine powder; the mixture should be made in a tall glass or tin vessel, just large enough to hold it, and the materials should be mixed together as quickly as possible. It is customary, when a great degree of cold is required, first to employ one mixture to reduce the temperature of the other substances to be afterwards used; and by taking these and other precautions, a cold equal to 98° below zero of Fahrenheit has been produced, which is far greater than is ever found naturally. Snow or ice, finely pounded, mixed with common salt, is an example of two such substances; they instantly liquefy, and reduce the thermometer from 32° down to 0°. The following is a table of several of these mixtures, with their effects, according to the experiments of Mr. Walker:—

Mixtures.	Parts.	Thermometer sinks from	to
Muriate of ammonia....	5	50°	10°
Nitre..................	5		
Water	16		
Nitrate of ammonia	1	50	4
Water	1		
Sulphate of soda.......	5	50	3
Diluted sulphuric acid ..	4		
Muriate of lime	3	32	—50
Snow	2		
Snow...................	2	—10	—56
Diluted sulphuric acid ..	1		
Diluted nitric acid......	1		
Snow, or pounded ice ..	12	—18	—25
Common salt	5		
Nitrate of ammonia	5		
Muriate of lime	3	—40	—73
Snow	1		
Diluted sulphuric acid ..	10	—68	—91
Snow...................	8		

The latent heat of water which is given out when it is converted into ice, and the absorption of heat when ice is converted into water, is of great use in the economy of nature, making the changes of temperature, both to winter and summer, gradual and salutary. In all cases, when liquids are converted into solids, their latent heat becomes sensible. There is a great affinity between water and lime, and when some of the former is poured on the latter, it combines with it, forming what is called a hydrate of lime; the water becomes solid, and gives out its heat of fluidity, which in many cases is sufficient to set casks, ships, and other combustible matters on fire. The thermometric heat of boiling water is 212°, and the heat of steam is also 212°. Water rises into ebullition, or boils, at 212°, but this is under the ordinary pressure of the atmosphere; and if the pressure be diminished, the water, as well as all other fluids, will boil at a lower temperature. The professor concluded by explaining the cause of the noise heard when vessels simmer and boil, which is so obviously the effect of the lower parts of the fluid rising in vapour, and parting with its heat to the water before the whole fluid has reached 212°, and when that is the case, passing through it in vapour, as escaping into the atmosphere, that it is hardly necessary further to illustrate the subject.

In his seventh lecture Mr. Brande began by saying, that he had in his previous lecture shown that liquids were converted into vapour by the addition of heat; and had remarked that when ice was thawed, it did not rise in temperature. In the same manner, when water is made to boil, it passes into steam without any elevation of its temperature. As ice is always of the same temperature with the water into which it is converted, so steam is always of the same heat as the water from which it arises. In speaking of the boiling point of water or other fluids, the common pressure of the atmosphere was always meant; and taking this at thirty inches, the boiling point of water is 212°. But the pressure of the atmosphere is continually fluctuating, and every fluctuation has an influence on the boiling point of fluids. With the barometer standing at 29°, water boils at 210° and a fraction; while, when the barometer stands at 31°, it does not boil till the thermometer has reached very nearly 214°. It is found that to make an alteration of one degree of Fahrenheit's scale, there must be an alteration of six-tenths of an inch of pressure. On this principle, liquids at an elevated situation boil sooner than at lower places; and even the distance between the bottom and top of a house makes a sensible difference. By the above-stated circumstance of the relation between pressure and the boiling point, we can either ascertain the height of places, or, knowing this, we can ascertain at what point water will boil. In the Philosophical Transactions for 1812, (Mr. Brande believed) Mr. Wollaston has described a thermometer by which the alteration in the boiling points of fluids may be made use of to ascertain very minute differences of height with great exactness. It consists of a large bulb and a very small scale or tube, and is so delicate that it marks the difference between the bottom and top of a room. Although this instrument may be employed to ascertain heights, it is difficult to keep it in order; and on the whole, for this purpose, a barometer is a better instrument. The effect of the pressure of the atmosphere on the point of the thermometer at which fluids boil, may be easily shown by placing them in an exhausted receiver. Water not near the boiling point, when thus treated, rises instantly into ebullition, and ether, spirits of wine, and other fluids, boil even at common temperatures by removing the pressure of the atmosphere. It appears, therefore, that it is this pressure only which preserves them in their liquid state; and if this were removed, they would exist as perma-

nently elastic fluids. The professor repeated these experiments, and spirit of wine and heated water both boiled in the air-pump on the receiver being exhausted. There is rather a problematical method of showing the effect of diminished pressure in making fluids boil, by plunging a flask containing water that has ceased to boil into cold water, when it begins to boil again immediately. This experiment was performed. A flask provided with a stop-cock was placed over a lamp, and the water it contained made to boil. When all the air was expelled, and an atmosphere of steam generated in the upper part of the flask, the communication with the atmosphere was cut off by the stop-cock, and the water removed from the lamp. After the ebullition had ceased, the flask was plunged into cold water, and the fluid began to boil again immediately. This is owing to the steam in the upper part being condensed by the cold water, and pressure being thus removed. These, then, are all cases in which diminishing or removing the pressure of the atmosphere lowers the temperature at which fluids rise in ebullition.

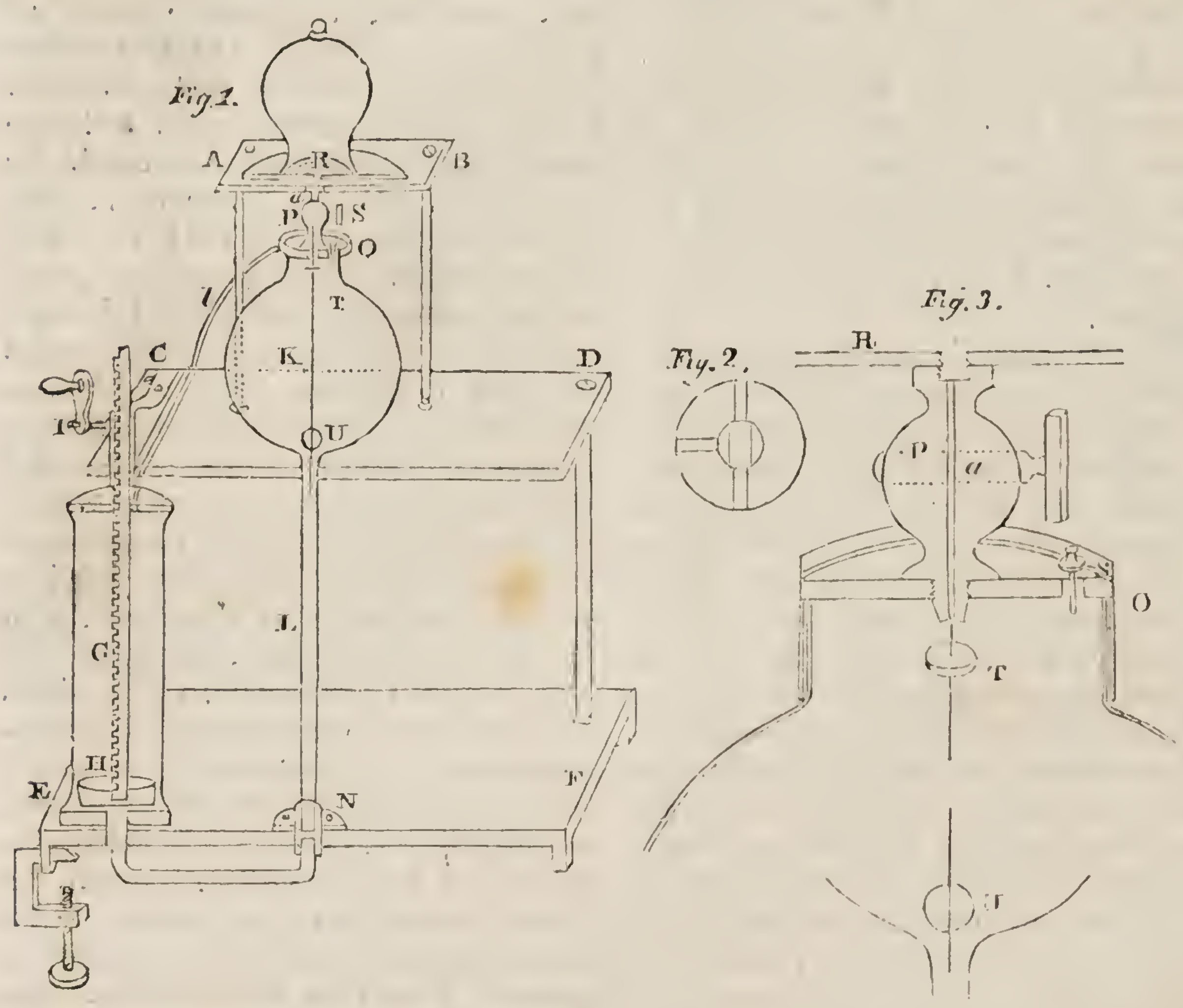
The reverse effect is produced by increasing the pressure. In the instrument called a digester, which is an iron vessel made with an air-tight lid, and provided with a valve, the steam cannot escape, and the heat of the water is increased so much, that much of the substance is taken from bones, which is never dissolved by water boiling under ordinary atmospheric pressure. By employing a degree of pressure corresponding to one additional atmosphere, the boiling point is raised to 269° and a fraction, or to nearly 270°. Every increase of pressure corresponding to an inch of mercury, raises the temperature 1° and 92 hundredths. The conversion of water into steam is analogous to the conversion of ice into water. Dr. Black, who was the first to make experiments on this subject, carefully observed the time required to make a known quantity of water boil, and then by evaporating it entirely, knowing at the same time the quantity of heat applied, he inferred that it required 907° of thermometric heat to convert water into steam. There is some difference of opinion as to the quantity of heat required, but this seems most correct; and as it is a quantity so much greater than is sufficient to boil water, it appears that there is in steam 1182 thermometric degrees. As might have been expected from this circumstance, a small quantity of steam, on being mixed with water, heats a large quantity of it. This effect is observed in the condensation of spirit in distillation, a small quantity of which heats a great quantity of water. The upper portion of the water, near which the vapour enters, nearly boils, and if the water were not to be renewed, the vapour would pass out at the bottom of the worm in the same state at which it enters at the top. The water for condensing spirits is constantly supplied from the bottom of the tub, and a waste pipe carries off the heated portion from the top. The condensation of a small quantity of steam in water makes it boil, and this mode of heating large quantities of water is now employed in several brewhouses, in dyeing works, and in other manufactories where large quantities of hot water are required. Many manufactories, also, are heated by steam, and steam is employed in many drying processes, as it allows of substances being exposed to a considerable heat without the danger of their catching fire. In such cases it is conveyed into and through pipes, and is made hotter or colder by greater or less pressure, as circumstances require. A high pressure steam boiler is very convenient in many operations of pharmacy and chemistry, as it enables the operator, by lessening or increasing the pressure, to carry on his works with the greatest nicety.

The professor made several experiments to show the manner in which pressure on steam increases its heat; and remarked as a very

curious circumstance, that steam, under a high pressure, when it first issues into the atmosphere, does not scald like low pressure steam. This is owing to its own increased capacity for heat at the moment, which makes it absorb all its own heat, or render it latent. The same effect is observed of air heated to a high degree, and allowed suddenly to expand. In concluding this part, Mr. Brande observed, that he had shown by various experiments the effects of heat in converting water into steam, in what manner this was modified by atmospheric pressure, and some of the uses to which steam might be applied.

Water also is evaporated, or rises into vapour, at natural temperatures, and exists in the state of vapour blended with the atmosphere. In this natural conversion of water into vapour, there is the same quantity of heat carried off as is observed by converting water into steam by artificial heat; but as it does not take place so rapidly, it does not produce the same depression of the thermometer. It may be made evident, however, that evaporation at common temperatures produced considerable cold; a little ether or spirit of wine poured on the hand produces this effect in a remarkable degree, and makes these substances useful as cooling lotions. Ether dropped over the bulb of a thermometer exposed to evaporation, lowers the temperature much below the freezing point. By accelerating the evaporation, we can produce an intense degree of cold. On this principle Dr. Wollaston has constructed his cryophorous. It consists of a glass tube with a bulb at each extremity, completely exhausted of air, but containing a small quantity of water in one bulb, and of course the remainder of the instrument is filled with vapour. To the bulb filled with vapour a freezing mixture is applied, which condensing the vapour, causes a rapid evaporation from the other bulb, and this evaporation is sufficient to freeze the remainder of the water. This is distillation at a very low temperature. The effect of evaporation in producing a great degree of cold is employed in warm countries, and in other countries, for the purpose of cooling water, wines, and other things: porous vessels are exposed to the action of the air, and as the water oozes through and evaporates from their surface, a great degree of cold is produced. On the same principle Mr. Leslie has proposed a means of forming ice on a large scale, which he supposes might be adopted in warm countries; but the difficulty of preserving the necessary instruments in good order, unless in very skilful hands, particularly in hot climates, seems a great objection to his scheme. It consists in placing a shallow vessel full of water in an air-pump, and also placing there some substance, such as sulphuric acid or dry oatmeal, or muriate of lime, which has a great affinity for moisture, and which, consequently, absorbs the vapour as it is formed. The air is then to be exhausted, and the evaporation from the water is so great as to be sufficient to freeze what remains. Mr. Brande tried this experiment, but it failed, though the thermometer in the water sank considerably below the freezing point. For this experiment any substance greedy of moisture may be employed, but oil of vitriol is as good a one as any. Mr. Brande then exhibited the experiment, which has already been described in our pages, of making water freeze and ether boil in the vacuum of an air-pump. The conversion of water into vapour, at the surface of the earth, is of great importance in the economy of nature. By it the temperature is kept moderate, and the vapour is spread through the air, which is afterwards deposited in the upper regions, and has a considerable influence on the temperature even of the most elevated places. The theory of the process in nature is the same as that exhibited in the experiments, but there it is more gradual and more constant. Mr. Brande con-

cluded his lecture by saying, that he should not enter into any inquiries into the cause of heat, which, he justly observed, was totally unknown. He would merely remark, that of the two theories, namely, that which attributed all the phenomena to vibrations, and that which described heat as a fine attenuated substance, the chemist would most probably choose the latter, as serving best to explain most of the facts which fall under his notice. Heat, considered as radiant matter, the professor means to treat of hereafter.



MR. PATTEN'S AIR-PUMP.

(*From the American Journal of Science.*)

THE construction of the pump is so simple, that it will require but a small share of skill or ingenuity to put it together, and it will be less liable to get out of repair than the pumps now in use. The valves, which in other machines are a great source of difficulty, may be made larger and stronger, and the apertures, of course, will be more accurately closed, without at all affecting the degree of exhaustion. The vapour arising from the oil necessarily used in all pneumatic instruments, is in this completely excluded from the receiver, and the vacuum in the *exhauster* being Torricellian, that in the receiver will approach as near to it as the elasticity of the air will permit. The glass parts of the instruments can be obtained from any glass-house, and the barrel (which would be more elegant of glass) can be made at any steam-engine or gun manufactory, and a clock-maker will be competent to construct the brass work. The plate represents a vertical section of a *table* pump, supposed to be divided directly through the centre, with one half of the wood work, to which it is attached.

Figs. 1 and 3 correspond in their lettering.

In fig. 1, A B, C D, E F, represent a vertical section of the instrument; G is a barrel of cast iron or glass, screwed firmly to the table E F, in it is the solid piston H, moved by the rack-work I; K is a glass globe resting upon the table

C D, of a little less capacity than the barrel G, with which it communicates by the glass tubes L and M, firmly cemented into the piece N, and into the bottom of the barrel G. To the top of the globe K is cemented the thick cap O, through which are made two apertures, into one of which is screwed the stop-cock P, communicating with the plate of the pump R; over the other aperture rests the valve S, opening into the atmosphere (the construction is seen in fig. 3). In the globe K is a stiff wire ascending into the cock P a short distance, and on it is screwed the valve T; the other end descends into the tube L, and to it is attached the wooden or cork ball U. We will now suppose the piston H withdrawn, and the barrel G filled with quicksilver; the tubes L and M being open will be filled to the height of the dotted line. Put the piston carefully in so that no air shall be between it and the mercury. As the piston descends the mercury rises, and when it reaches the ball U it floats it, and by means of the wire forces the valve T against the aperture that communicates with the receiver R, and as the mercury continues to rise, the air driven before it has no way of escaping but through the valve S. The piston is now at the bottom of the barrel, and the globe is full of mercury; if the piston be now drawn up, a vacuum would be formed in the *barrel*, but the mercury in the globe *must* descend, as it is above the level of the piston the whole height T, and the vacuum in the globe K would be Torricellian were there not a communication between it and the receiver R. When the mercury again ascends into the globe, it expels every particle of air, provided the mercury rises into the aperture at S; and to ensure this the cap O is formed into a rim, so as always to supply the contraction or waste, and it is admitted towards the end of the exhaustion by raising the valve S with the finger. The air is admitted through a hole *a* in the cock P: a section is shown, fig. 2. The cap O should be strong, and, if brass, should be coated with the cement used in attaching it to the glass (that used for nautical machines is best;) the gauge may be attached to the cap, or inclosed in the receiver.

The stiff wire, with the valve T and the ball U, may be entirely removed; and for it may be substituted a glass tube, open at both ends, cemented into the cock P, and reaching almost to the bottom of the globe. The mercury, when it rises to the lower end of this tube, cuts off the communication with the receiver. This will perhaps be the simplest and best plan. It may be made a double pump by connecting the cap O with the barrel G, as on the dotted line *b*—one valve opening in and one out. The weight of the mercury will be no objection, as the machine is small, the diameter of the globe about four inches, the height of the barrel about eight, and the whole height to the plate R, 15 or 20 inches.

DICTIONARY OF CHEMISTRY.

CLARIFICATION. The process of purifying a fluid, generally by the addition of some other substance. Albumen, gelatine, blood, and lime are substances in common use for this purpose.

CLAY (pure), *alumina*.

CLAYS (common). Of this useful earth, alumina, most generally mixed with silica and oxide of iron, in different proportions, is the base. There are several varieties, such as *porcelain earth*, *Kaolin*, *potters' clay*, *loam*, *variegated clay*, *slate clay*, &c., almost all of which are put to some use, some one or other of them being the principal ingredient in all pottery, earthenware, and china.

CLAY SLATE, *argillaceous schistus*, *argillite*. A mineral which is extensively distributed, forming a part of both primitive and transition mountains. It is composed of 48.6 silica, 23.3 alumina, 1.6 magnesia, 11.3 peroxide of iron, 0.5 oxide of manganese, 4.7 potash, 0.3 carbon, 0.1 sulphur, 7.6 water and volatile matter. It melts very readily before the blow-pipe into a shining species of glass.

Cleavage. A term used in speaking of crystals, and it signifies the direction in which their different parts are mechanically applied to each, or how they may be mechanically divided. By knowing this, the inclination of those laminæ, or parts, to each other, are discovered, and the crystals easily dissected and described.

Climate is a general term signifying the peculiarities of any district or region, as to *heat*, wind, rain, pureness of air, &c. &c., and such atmospheric phenomena as have an immediate relation to animal and vegetable life. These circumstances are all mainly dependant on the latitude of the place, its elevation above the level of the ocean, and its proximity to or distance from the sea. Of late years numerous and very interesting observations have been made, particularly by the celebrated traveller Humboldt, Professor Leslie, and others, on all the circumstances which influence climate, which will, in due time, be noticed in The Chemist.

Chinometer. An instrument for measuring the dip or direction with regard to the horizon, of mineral strata.

Cloud. A term which needs no definition. Clouds probably consist only of vapours, more or less dense, formed or sustained at different heights in the atmosphere. Luke Howard, Esq., has classified clouds, and invented a series of terms for describing them with philosophical precision. In the sixteenth and seventeenth volumes of the Philosophical Magazine the reader will find some of his remarks on this subject.

Club Moss, *lycopodium lavatum*. Its seeds are combustible and explosive, and are used in theatres to make lightning. They consist of a fixed oil, sugar, and mucilage.

Clyssus. A name given by the alchymists to the water or vapour which they obtained by detonating nitre with charcoal or phosphorus, and to which they ascribed a great many virtues.

Coak. The charcoal of coal. It is made by exposing coal to a strong heat, and preventing the free access of the atmosphere.

Coal. One of the most important and useful minerals of the globe. It is more abundantly found and worked in Great Britain than in any other country. There are various kinds of coal, most of which have properties that render them valuable for some purpose or other. Chemically, coal is a compound of carbon, hydrogen, and oxygen, with an incombustible residuum.

SIR HUMPHRY DAVY's COPPER.

We again refer to this subject, to put the question which is now keenly agitated, as to the value of Sir Humphry's discovery, on the proper basis. The newspapers have taken the matter up; Sir Humphry has written a letter to the *Times*, and it may now be called a public question. We have no respect for the manner in which the learned President proceeded, more particularly as we learn from his own letter, that the very committee, the meetings of which he attended only once, as already stated in the letter of our Correspondent,* was suggested by himself. We have also no respect for the undue pretensions of the President; and we see with dislike his jealousy of others. But we cannot, therefore, side with those who say that his researches have failed and his experiments been unsuccessful. The object of inquiry was "a means of preventing the *decay* of copper sheathing." It seems satisfactorily proved, that this object has been completely attained, and that Sir Humphry has, by an ingenious application of Voltaic electricity, secured the copper from the corrosive effects of sea water. But in executing his project, it is found, as has been more than once stated, and not denied, that copper, at least in this particular electrical state, so far from being, as is usually believed, destructive of animal life, is, in fact, beneficial to it, and crowds of little fish adhere

* Chemist, No. XXXI. p. 47.

to the bottoms of ships coppered in this way, as it appears, even to a greater degree than they adhere to the wood. The ships' bottoms become foul in a short time, which impedes their motion through the water; and consequently copper prevented from decay by Sir Humphry Davy's method does not answer for sheathing ships. This is owing to a circumstance which is so contrary to general experience, that nobody could foresee it; and the discovery of this circumstance is of itself a benefit, for it leads to correct knowledge. We have now a *means of preserving copper*, what we next want is a means of keeping it clean, and preventing shell-fish from adhering to it. That this object will be accomplished in a short time we have no doubt, either, as has been proposed, by allowing the copper to be slightly destroyed, or by some other less costly means. The object of Sir H. Davy's investigation was the preservation of copper sheathing; in this he has fully succeeded, but he has been disappointed in the utility of its application to the purpose immediately in view by an unforeseen difficulty, which his ingenuity will most probably surmount.

QUERY.

What law does cast-iron follow in expanding from the effect of heat? Does it, like water, present any anomalous phenomenon? if so, where may I find it described?

I am induced to put this question from finding in Parke's Chem. Cat., 7th edit. p. 94, the following passage:—"More perfect castings may be obtained from iron than from any other metal, as it always *expands in cooling*." The same assertion is to be met with in other chemical works, and I have also heard it announced in lectures. But experience leads me to doubt the truth of the statement. A moderate increase of temperature certainly causes an expansion in cast-iron, as in other bodies, and though I have never seen any experiments made at the point of fusion, I presume that the same law is followed throughout, from the fact, that the pattern makers in the foundries make an allowance of one-eighth of an inch per foot, in order that the casting, when cold, may be of the desired length.*

I am, Sir, Your obedient servant,
Crux.

CONTRACTION BY COLD.

Some years ago it was observed at the *Conservatoire des Arts et Metiers* at Paris, that the two side walls of a gallery were receding from each other, being pressed outwards by the weight of the roof and floors. Several holes were made in each wall, opposite to one another and at equal distances, through which strong iron bars were introduced, so as to traverse the chamber. Their ends outside of the wall were furnished with thick iron discs, firmly screwed on. These were sufficient to retain the walls in their actual position, but to bring them nearer together would have surpassed every effort of human strength. All the alternate bars of the series were now heated at once by lamps, in consequence of which they were elongated. The exterior discs being thus freed from the contact of the walls, they could be advanced further on the screwed ends of the bars. On the bars projecting on the outside of the walls from the elongation, the discs were screwed up; on removing the lamps the bars cooled, contracted, and drew in the walls. The other bars became, in consequence, loose, and were then also screwed up. The first series of bars being again heated, the process was repeated; and by several repetitions the walls were restored to their original position. The gallery still exists with its bars, to attest the ingenuity of its preserver, M. Molard.

TO MAKE TREES BLOSSOM IN WINTER.

Mr. Editor,—As winter is fast approaching, and its amusements will be eagerly sought after, allow

* We believe the fact is, that iron expands, like ice, though not to so great a degree, at the moment of congelation. In cooling, after it has become solid, it contracts.

me to suggest to the attention of your English readers the following German method of preparing in winter those real flowers and trees with which we are accustomed to decorate our rooms whenever a birthday or other feast occurs in our families. You don't know, Sir, half the pleasures and amusements that we have in the stove-heated rooms of my country; I assure you, Sir, they are much better than your gay fire-places, for we have in them an equal warmth, while I am now sitting writing close to a large fire, which scorches me on one side while the other is almost froze from the draught of cold air this fire draws in through every chink in the apartment. But to say nothing further of this, and show your readers how we make flowers in the middle of winter. We saw off such a branch of any tree as will answer our purpose, and then lay it for an hour or two in a running stream, if we can find one. The object of this is to get the ice from the bark, and soften the buds. It is afterwards carried into one of our warm rooms, and fixed upright in a wooden box or tub, containing water. Fresh burnt lime is then added to the water, and allowed to remain in it about twelve hours, when it is removed, and fresh water added, with which a small quantity of vitriol is mixed, to prevent its putrefying. In the course of some hours the blossoms begin to make their appearance, and afterwards the leaves. If more lime is added, the process is quickened, while, if it is not used at all, the process is retarded, and the leaves appear before the blossoms. Here, Sir, then, we make both flowers and leaves in the midst of winter, which is for us a great gratification, as it is our national taste to adorn our houses with them as much as possible, both in winter and summer.

I am, Sir, Your Correspondent,
EIN DEUTSCHER.

TO CORRESPONDENTS.

We have balanced the praises of Crux against his censures, and find ourselves on the whole a gainer. *His* gilded pill will not purge us of our faults. We concede to him, that the lecturer he mentions is fluent in delivery, distinct in enunciation, and successful in experiment, but here his praise must end. He is only master of the details of his subject, and only clear because he is shallow. He has no originality, no enthusiasm; appears to take no interest in what he teaches, and excites none in his auditory. If Crux looks again at our Preface, he will find we spoke not of *upper classes*, but of Royal Societies, and those who stand at the head of science. If he will furnish us with a single instance of their assisting to promote scientific knowledge among the people, we will readily publish it, and, as far as we can, make it known to the world.

We are glad to learn from a Lover of Science, that Mr. Lewthaite's Lectures on Experimental Philosophy, at Camberwell, give satisfaction, but we cannot take any further notice of them.

The query of E. R. W., in its present state, is incomprehensible, as *flesh* and *muscle* are the same. To separate the integuments from the muscle, it is customary to immerse the substance in water.

A copy of the Rules of the Chemical Society was sent to our Publishers' for Mr. Riley as soon as we received his letter. We hope he received it.

Investigator has been received.

The pages of the Chemist are much too prosaic for the "*doggrel*" of H. A. R.

We do not exactly comprehend the inquiry of A Constant Reader as to stained woods. There are many species of wood imported from abroad subject to a custom-house duty; but we are not aware that any excise duty is imposed on any species of wood the *growth* or manufacture of Britain. If he makes his inquiry more precise, we will endeavour to give him a satisfactory answer.

James Edwards will find a copy of the Rules of the Chemical Society left for him at our Publishers'. He may obtain further particulars of the Society by applying to the Secretary, Mr. Jones, No. 19, Aldermanbury. His being only a beginner will be no bar to his admission.

A Constant Reader (by the bye, we have so many, that we are troubled to distinguish them, and would be glad if our Correspondents assumed some other signature,) is informed, that Mr. Brown's engine, which we saw, was only a model; and that this model when at work raised up a small quantity of water three or four feet. The exact quantity of gas it consumes in proportion to the work Mr. Brown expects it to perform, has not, we believe, been yet stated by the inventor.

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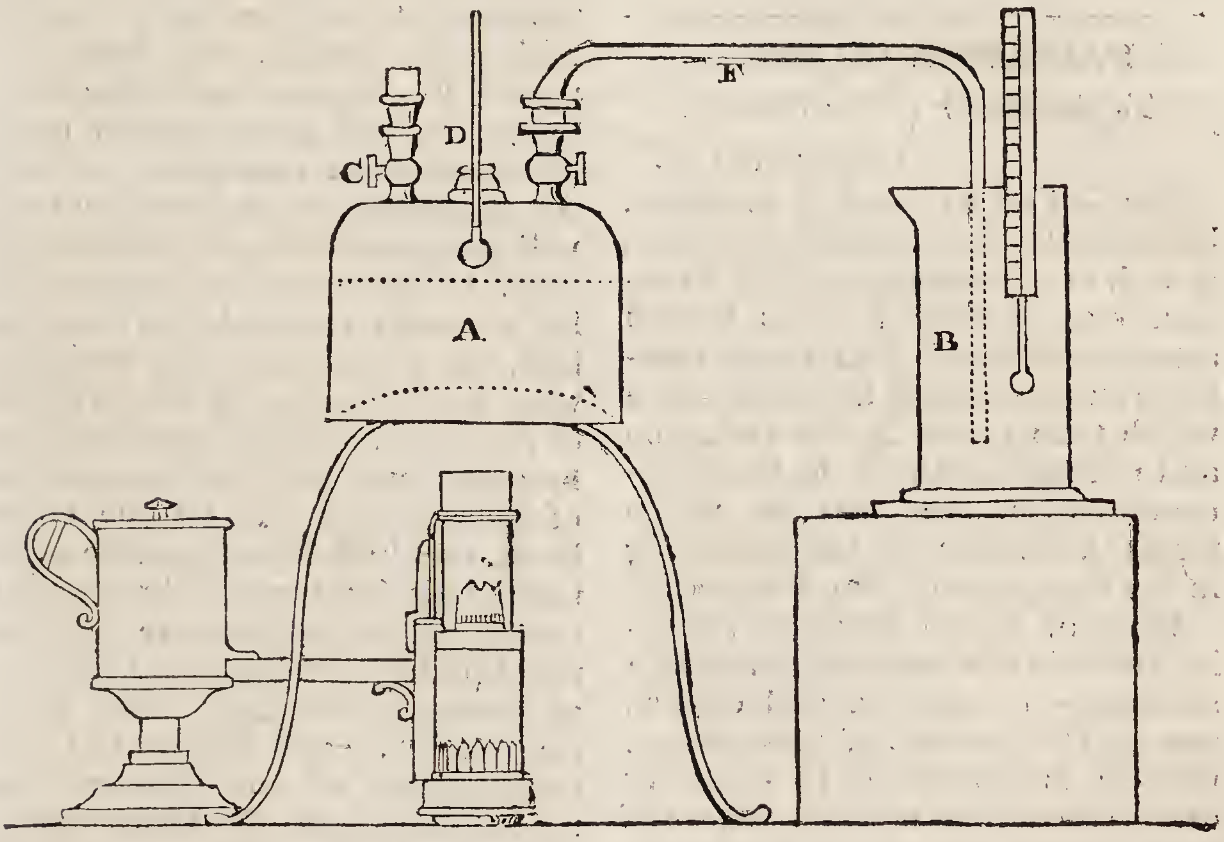

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LATENT HEAT OF STEAM.

We here present our readers with a representation, taken from Dr. Henry's Elements of Chemistry, of a small boiler, which is very convenient for making experiments on the latent heat of steam. The tube F must be screwed on at the stop-cock E, (a reference which our engraver has omitted,) and immersed in a glass of water B. The cock C being closed, the steam arising from the boiling water in A will pass into the cold water in B, the temperature of which will be augmented by the condensation of the steam. By ascertaining the increase of temperature and weight, we may learn how much steam has served to raise the temperature of the water a certain number of degrees. If to another quantity of water, equal in weight and temperature to the water originally

contained in B, as much water be added at 212 as is equal to the weight of the condensed steam, we can easily compare the effect of the two in raising the temperature of the water; and it will be found, that the same weight of steam has added much more heat than the boiling water, though its temperature was, like the boiling water, only 212°.

RADIATION OF HEAT.

To the Editor of the Chemist.

London, Oct. 18.

Sir,—You will not, I presume, be offended if, in compliance with a wish expressed in your 32d Number, one of your readers should attempt a better and more complete explanation of the phenomena which take place in the radiation and reflection of heat, in the experiment with the mirrors, which forms the subject of the engraving in the first page of that Number.

Heat or (more properly speaking) caloric is to be considered as a substance or matter, and cold as merely the absence of this matter. Caloric is supposed to exist in every substance, no such degree of cold having yet been produced, which might not be supposed capable of being reduced still lower. Every substance is constantly radiating its caloric to surrounding bodies: if the surrounding medium be of the same temperature, or contain as much free caloric as this substance, the interchange of caloric will be equal, and consequently they will both remain at the same degree of temperature; if, on the contrary, the surrounding medium be colder than the body, or *vice versa*, the interchange of rays will be in favour of the colder substance, which will, consequently, be increased in temperature at the expense of the warmer body, until both are reduced to the same degree.

On this principle, it is a very easy matter to account for the phenomena which take place in the experiment with the concave mirrors, which, you have shown, radiate the caloric of a substance placed in the focus of one, to any other substance placed in the focus of the other. Suppose an iron ball, previously warmed by the fire, or by other means, to be placed at the focus of one of the mirrors, and one of the bulbs of a differential thermometer, placed at the focus of the other: it is evident that the caloric contained in the ball, having always a tendency to diffuse itself equally with other bodies, and being directed by the mirrors to the thermometer, will load it with more caloric than it contained before; the thermometer at the same time will radiate its caloric towards the ball: but the thermometer containing so much less caloric than the ball, the interchange will be in favour of the former at the expense of the latter, and the thermometer, by rising, will indicate an increase of temperature. If, on the other hand, the ball, by a frigorific mixture, or by other means, be reduced to a degree of temperature inferior to that of the thermometer, they will, as before, both radiate their caloric towards each other; but the temperature of the thermometer being superior to the temperature of the ball, the interchange will be in favour of the latter at the expense of the former, which is evinced by the falling of the thermometer.

If, Mr. Editor, you regard this explanation of the fact superior to that in the above-mentioned Number, it is quite at your service.

I am, Sir,

Yours, &c.

William Yael.

LAWS OF NATURE.

To the Editor of the Chemist.

Sir,—The Article in your 32d Number, on the "Contraction and Expansion of Water in cooling," has always appeared to me one of those facts which have become familiar to us by constant repetition, and have been passed by without that degree of consideration which their importance deserves. There is something, in my mind, so pre-

posterous and absurd in the idea of an exception to *a law of nature*,* that I am inclined to believe the difficulty in accounting for it arises from our ignorance of the nature of the theory of heat, particularly as the same effect is observed in some other substances totally dissimilar in their nature, viz. in some of the metals and saline solutions during crystallization. There is, perhaps, no theory so little understood, and which affords more scope to the ingenuity of the philosopher, than that of heat. The too hasty adoption of the term caloric, as the cause, and heat, as the effect, thereby presuming caloric to be a distinct species of matter, has given rise to hypotheses, which will not stand the proof of experiment, and only tend to mislead by their apparent plausibility. Because, in almost all cases, bodies in passing from a liquid to a solid state emit caloric, and *vice versa*, it is adopted as an established axiom, that caloric is the cause of fluidity, and consequently that the abstraction of caloric is the cause of solidity. Let us just examine how far this position is borne out by facts in the case of crystallization. In all cases of solution there are two opposing forces: the force of cohesion in the moleculæ of the substance in solution, and the solvent power of the liquid. Suppose, then, we take a solution just at the point of saturation, where these two forces are at an exact equilibrium, the solution still continues in a liquid state; but by introducing a small particle of the substance dissolved, crystallization will instantly take place, and the temperature of the solution will be raised. The same effect takes place in the congelation of water, which may be reduced some degrees below the freezing point 32°, and still retain the liquid form; the slightest agitation, or the immersion of a small spicula of ice, will instantly cause it to solidify, and the temperature will be raised to 32°. In these cases, would it not be more proper to say, that the solidification of the substance was the *cause* of the emission of caloric, than that the abstraction of caloric was the cause of the solidification of the substance?

Of the expansion of metals, the only cause that has been assigned is, that of the peculiar arrangement which the moleculæ of all bodies tend to assume in consequence of their reciprocal affinity. This explanation has also been given in the case of crystallization. There is another, however, which might with equal probability be urged, viz. the solidification of the water of crystallization. In the congelation of water (*per se*) this cause is evidently inapplicable; for according to the experiments of Mairan, Blagden, and Dalton, the expansion takes place in proportion to the reduction of temperature, although the water still retains its liquid form. A farther advancement in science may, perhaps, enable us to account for this apparently anomalous phenomenon; until then, I shall always be more disposed to attribute our inability to human imperfection, than allow an exception to a general law of nature.

Your obedient servant,

OBSERVATOR.

* Our Correspondent seems to understand the terms "law of nature" in a very different sense from that we attribute to them. In natural philosophy, these terms do not mean a *decree*, the execution of which, when an exception to it is described, is suspended. They are general terms given by us to many similar facts. In the present case, it has been observed of numerous bodies, that they expand on the application of heat; and we have generalized this, and say all bodies expand by heat. On further examination, however, it is found, that water is an exception to our generalization; and this is all which is meant by saying, it is an exception to a law of nature. One great object of all philosophy is, to arrange all such exceptions also under some general expression, which is then termed a law of nature. Of course all exceptions to such laws are exceptions only to our own forms of expression. As philosophy extends its bounds these exceptions gradually disappear; and we shall always welcome any communications, which, like the present, tends to make us cautious in adopting theories, for they are only generalizations of individual phenomena.—ED.

DICTIONARY OF CHEMISTRY.

Coating, in chemistry, the application of some substance to the surface of chemical vessels. A mixture of marl soaked in water and then kneaded with fresh horse-dung is recommended by Chaptal. In electricity, coating is the application of a metallic substance to the surface of a non-conductor, such as glass, to diffuse the electricity over every part of it.

Cobalt. An undecompounded metal. A beautiful blue is obtained from the phosphate of this metal, which is one of the best colouring substances for glass we have any knowledge of. Some of the salts of this metal have the property of changing their colour when heated, and are employed to form sympathetic inks. It received its name from the difficulties its ores gave to the miners, *Cobalus* being the demon of mines.

Coccolite. A green coloured mineral, consisting of silica 50, lime 24, magnesia 10, alumina 1.5, oxide of iron 7, oxide of manganese 3. It is found in Norway, Germany, and Spain.

Cocculus Indicus. A poisonous berry, the fruit of the *menispermum cocculus*, a shrub which grows amidst rocks and sands on the coast of Malabar and other parts of India. The deleterious principle in the berry, which is bitter, has been named *picrotoxia*. It is sometimes employed to poison fish; it is in use as a medicine, and is said to be administered in small doses to most of the inhabitants of this metropolis in their beer.

Cochenilian. The name given by Dr. John to the red colouring matter of the cochineal insect, which in his opinion is a peculiar animal principle; it constitutes one half of the whole substance of the insect.

Cochineal. An insect obtained in Mexico, and much employed in dyeing. Scarlet, one of the most splendid colours given to cloth, is produced by this insect. It was formerly supposed to be a grain, and still retains this name among dyers.

Coffee is the seeds or berries of the *coffea arabica*. Independent of its use as a refreshing drink, it is employed in medicine as a corrector of opium. It should be given in a strong infusion, and is said to be better cold than hot.

Cohesion. The power by which the particles of bodies are held together. Various experiments have been made on the cohesion of different bodies, and tables of their cohesive powers drawn up, to which we must refer.

Cohobation. The continuous redistillation of the same liquid from the same materials.

Colcothar, *crocus, crocus martes*. The oxide of iron which remains after the distillation of the acid from *sulphate of iron*.

Cold was formerly supposed to be a separate substance, but is now generally regarded as the privation or absence of heat. It is very doubtful if either theory is correct.

Collyrite. A snow white mineral, found in Hungary, and consisting of silica 14, alumina 45, water 42.

Colophonite. A blackish mineral, the *resinous garnet* of some authors, consisting of silica 35, alumina 13.5, lime 29.0, magnesia 6.5, oxide of iron 7.5, oxide of manganese 4.75, and oxide of titanium 0.5.

Colophony, *black resin*. The residuum after the separation of the light oil and dark reddish balsam from turpentine.

Columbic Acid. A peculiar acid formed by the metal columbium and oxygen.

Columbite, *tantalite*. The name given by Mr. Hatchett to the mineral from which the ore of columbium was first procured by him.

Columbium. An undecomposed metal, of which only a small quantity has been obtained, and of which little is known.

Combination. That intimate union of different substances which disguises the properties of each, and gives properties to the compound not before sensible. It is different from "Mixture," which consists only in blending substances together, the properties of the individuals remaining sensible after they are mixed.

Combustible. A body which in its chemical combinations with others causes a disengagement of light and heat. All combustibles have a different temperature at which they begin to emit light and heat, when, if air be present, they continue the emission till all the combustible part is dissipated.

SPONGY PLATINUM.

The use of this substance to procure instantaneous light, as well as the extraordinary nature of the phenomenon, makes the following remarks of Mr. Turner, taken from a paper in the Edinburgh Philosophical Journal, of considerable utility:—"On exposing pure spongy platinum to the air and dust of an ordinary sitting-room, the metal gradually loses its peculiar property. After three days it still became luminous from a jet of hydrogen, but at the end of six days no action ensued, not even when it was put into a mixture of oxygen and hydrogen. By simply igniting the platinum, its energy was completely restored. A piece of platinum was kept in a closed drawer of the same apartment, in such a manner, that it was freely exposed to the air, but protected from the dust; at the close of a fortnight it still set fire to hydrogen, though its energy was somewhat diminished. Some of the metal was kept a month in a dry bottle, furnished with a glass stopper, and then it acted quite well. A platinum ball lost and retained its energy under similar circumstances. A piece of active platinum invariably failed to give light, if kept 24 hours on mercury, the effect being the same whether it was covered with an inverted jar or not; on keeping an active ball in contact with mercury two hours, its energy was perceptibly impaired. The action of mercury is still more injurious when a heated ball is plunged in it, and held there during a few seconds."

Spongy platinum also absorbs water, ether, and alcohol, and loses its flame-exciting energy when immersed in sulphuric, muriatic, or nitric acids; it does not act on an explosive mixture, but ignition restores its activity. Spongy platinum was pressed between two pieces of clean metal, till it had become a compact leaf, and its effect on a jet of hydrogen was tried at different stages of the process. As long as any of the porous texture remained, it became luminous; but when this was wholly destroyed it gave no light whatever. A very gentle heat still enabled it to become luminous and inflame the hydrogen.

RELATIVE VALUE OF COAL AND OIL GAS.

In consequence of the experiments on this subject made by Professor Leslie, to which we alluded in the Chemist, vol. i. p. 408, a very long statement has been published by the Edinburgh Oil Gas Company. Mr. Turner and Professor Christison have been employed by the Company to examine Professor Leslie's experiments, and they declare them to be erroneous, because the instrument he employed to measure the light given by the two gases, his photometer, is more affected by heat than light. In this opinion they are supported by Dr. Brewster; and the Oil Gas Company affirm, that till other experiments prove the contrary, the light given by oil gas must be considered,

when compared to that of coal gas, as $3\frac{1}{2}$ to 1. These gentlemen are all now engaged in making experiments to set this question at rest; and when the results are known, we shall lay them before our readers. We must, at the same time, add, that Dr. Fyfe, who was paid by neither company, and who has recently made some more experiments with great care, has repeated his statement, that the relative burning power of the two gases is as 1 to 1.8.

GAS AND CANDLE LIGHT THE SAME.

Mr. Editor,—What a fuss some people make about the gas-lights. I was yesterday in company with an old gentleman on the outside of a coach, who seemed to think every human infirmity arose from burning gas. He had been ordered by his physician to drink nothing but water, and his face indicated pretty clearly for what reason: he said, however, he had been made seriously ill by going into a room stuck full of gas lamps. One young woman, who was suffering by a cold, had been, according to him, half choked by gas. A gentleman, who was by nature short-sighted, had been made blind, he said, by gas. He told us of a friend of his, who had been so foolish as to light his shop-windows with it, and even his house; and in one week, therefore, the whole family fell sick. You may be sure, Sir, he had not forgotten any one explosion of which he had ever heard. His memory was like a Newgate Calendar, full of misfortunes. It was of no use reasoning or arguing with him; he would believe nothing, because he knew nothing: so I must beg you will insert in your miscellany, a statement, which, if it does not convince people gas is not pernicious, they will at least grant that it is not more so than candles; for the tallow is actually converted into gas before it is consumed. "When oil is burnt in lamps," says M. Clement, "it rises in the wick by capillary attraction to the flame, and is there *decomposed*, as if it were in a red hot cylinder; olefiant gas and super-olefiant gas are both produced: it is *these gases* which produce the light. In burning both wax and tallow candles, precisely the same thing occurs. The tallow or wax is first heated by the flame, then decomposed, and the light is produced by the combustion of the gases." Each candle, therefore, may be considered as a solid gasometer, the gas being set at liberty by the action of heat instead of turning a stop-cock. After this, Sir, I hope we shall no longer be told of the pernicious effects of burning gas.

I am, Sir,

Your obedient servant,

Anti-tallow.

MEANS OF PREPARING A BEAUTIFUL GREEN FOR PAINTING PAPER.

Dissolve a small quantity of verdigris in a quantity of boiling vinegar in a copper caldron, and add to it one part of a solution of arsenic in water. During the mixture of these liquids a dirty green is precipitated, which must be again dissolved, to be purified. For this purpose a small quantity of vinegar is gradually added, till the precipitate is quite dissolved. The mixture is then boiled; after a short time a precipitate takes place, of a most beautiful green, which, when separated from the liquid, washed, and dried, is the colour. If the liquid still contains copper, more arsenic is added; and if it contains arsenic, more copper is added, and proceed as before. If the liquid contains an excess of acetic acid, it may be employed again to dissolve verdigris. The colour has a shade of blue. To produce a deeper green, with a shade of yellow, dissolve one pound of the potash of commerce in a sufficient quantity of water, add to it ten pounds of the colour, and heat it at a slow fire.

In a short time it will obtain the required colour. If too long boiled, the colour approaches Scheele's green, but has a greater brilliancy. The alkaline liquid may still be of use to prepare Scheele's green.—*Bulletin des Sciences Technologiques.*

QUERIES.

To the Editor of the Chemist.

Sir,—I have lately been engaged in making some experiments on the formation of various coloured dyes, in the course of which I encountered a difficulty, which I hope, by the aid of some of your Correspondents, to be able to remove. After boiling some logwood a considerable time, I added a small portion of sulphate of alumina, but found that, immediately on its introduction, the logwood was precipitated, leaving but a slight tinge of blue in the liquor, by which scarcely any effect was produced on the skein; when, indeed, a few drops of sulphuric acid were added, the coalition was restored, but the liquor was too red for use. In order to remedy this, I introduced a little carbonate of soda, but found that if the quantity was small it had not sufficient effect; but that if it was increased, the acid was of course overcome, and the logwood again separated.

If you will favour me by inserting this in your next Number, I doubt not some one of your Correspondents will have the goodness to inform me, both of the reason why the precipitation took place, and also of the means whereby it may be remedied or prevented?

I remain, Sir,

Yours, &c.

Oct. 18. Investigator.

Mr. Editor,—It is a general opinion, that when a substance is burnt in the open air, it combines with the *oxygen gas* of the atmosphere. Admitting this to be the case, I wish to know what particular circumstance it is which makes combustion, when it takes place in *oxygen gas*, previously separated from all other gases, so much more brilliant than when it takes place in the mixed atmosphere,—seeing that, in both cases, the combustion is merely the union of the combustible body with a certain quantity of oxygen? Is it, Sir, that the previous separation, like the mechanical division of some combustibles, which is necessary to make them combine with oxygen, brings a greater quantity of oxygen into immediate contact with the combustible, (when the oxygen is mixed with azote a portion of the latter is of course in contact with some part of the combustible) and the union thus takes place in a shorter time? or is it, that oxygen gas is a better medium for the transmission of light, or is it any other cause? I should be much obliged to any of your scientific readers to answer these questions, as it is clear, since combustion, whether taking place in the mixed atmosphere or in the already separated oxygen gas, is merely a union of the combustible with a determinate quantity of *oxygen*, that the greater splendour and greater heat produced in one case than the other is not at present accounted for?

I am, Sir,

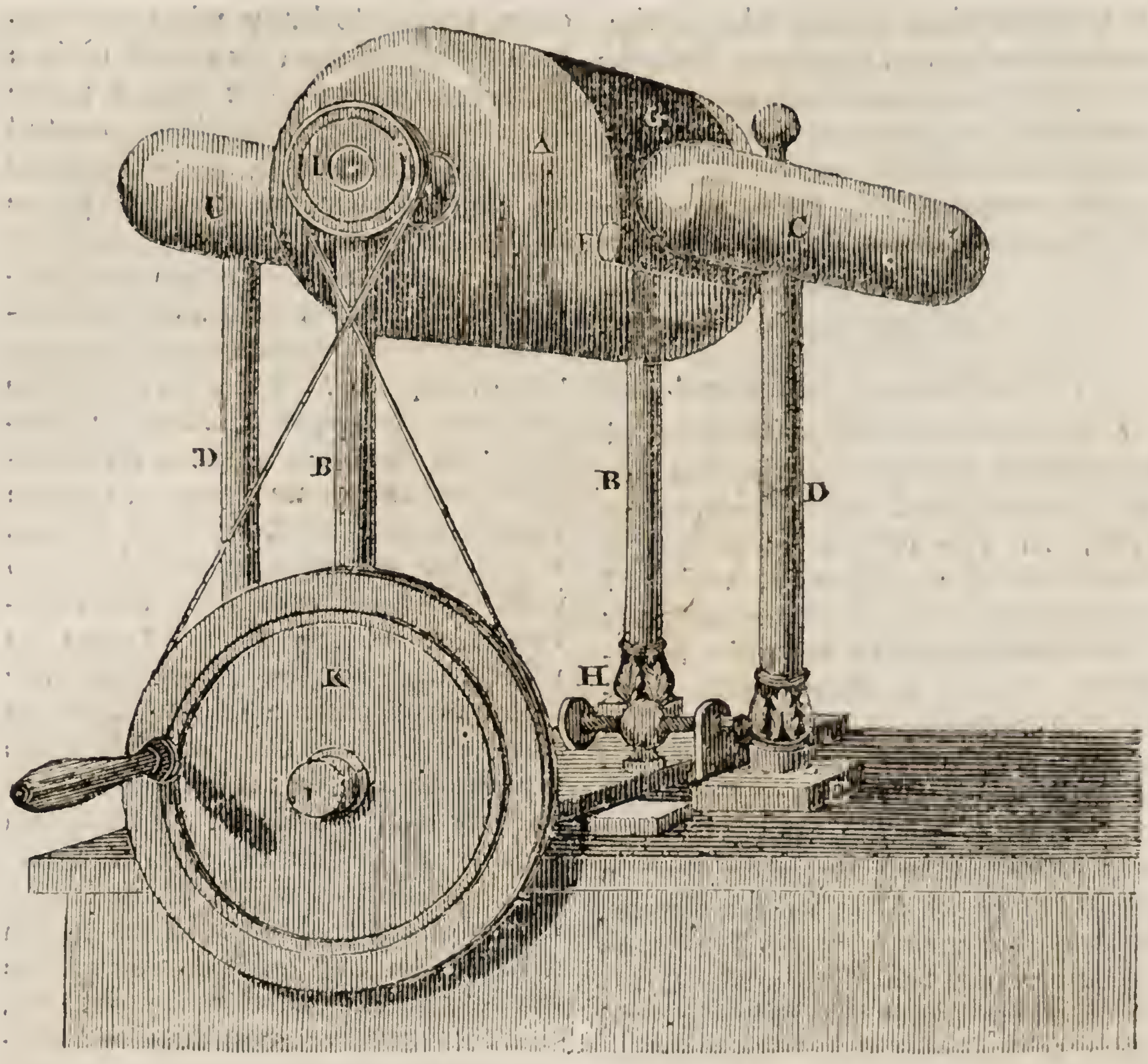
Your obedient servant,

Simon Pry.

An easy method of forming a small receiver for the electric fluid?

By what means, without the aid of an air-pump, can I exhaust the air from a phial, or other small body?

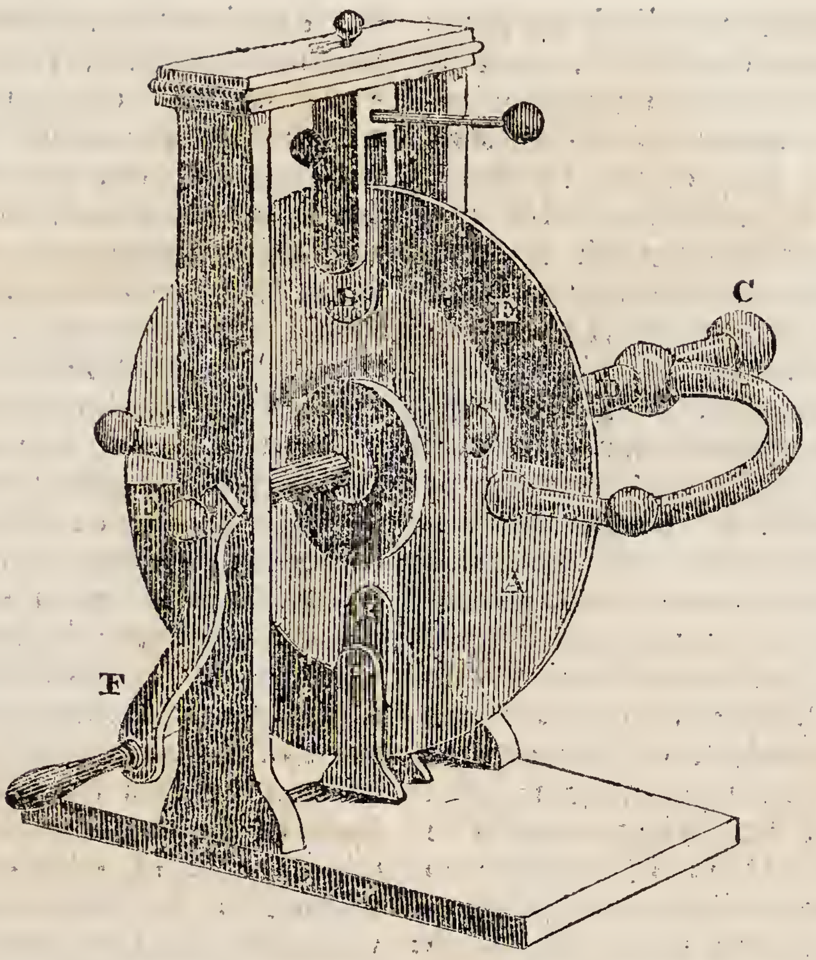
Has any other method yet been discovered to retain sodium and potassium in a metallic state, than that of keeping them in naphtha?



LECTURES ON CHEMISTRY AT THE ROYAL INSTITUTION.

ELECTRICITY.

LECTURE 8. We now come, gentlemen, Mr. Brande said, to treat of electricity, which includes some of the most remarkable phenomena concerned in chemical changes. The name is derived from the Greek word signifying Amber, in which some of the facts of electricity were first observed, and was extended to that part of science which treats of the repulsive and attractive powers which can be imparted to various forms of matter. Though first observed in amber, it is a property which belongs to many other substances, and there is probably none which may not be made to exhibit electrical phenomena. The repulsions and attractions are generally connected with other effects, such as the production of light, and seem, as will hereafter probably be proved, to have a close and intimate connexion with the chemical powers of matter. There is nothing peculiar in a tube or cylinder of glass, or a piece of sealing-wax, but if either of these substances are rubbed, the former with silk, the latter with flannel, they attract or repel light bodies. In a dark place they emit flashes of light, and if held up to the face, excite a sensation as if a spider's web were drawn over it. On a table before the professor was a collection of electrical apparatus, and among it a brass stand with two long arms, to each of which a feather was hung. On rubbing a tube of glass with silk and a stick of sealing-wax with flannel, and bringing either of them near one of the feathers, it was immediately put in motion, being either attracted or repelled, according to the state of its own electricity and the electricity of the glass or wax. Both these rubbed bodies, he observed, possess the same power of affecting the feather. A dry sheet of writing-paper rubbed with a piece of Indian-rubber, and held up to the feathers, also put them in motion. In performing this experiment,



the professor rubbed the sheet of paper while folded, and held the inside of the sheet up to the feather. All bodies electrically excited, he continued, appear luminous, and the opposite effects of attraction and repulsion seem to depend on the nature of the substance excited. There are, then, two states of electricity, which have been distinguished by the names of electro-positive and electro-negative. It had been supposed that these effects were owing to a very subtle attenuated fluid, which pervades all matter, and of which the equilibrium is disturbed by the excitation. If in the sealing-wax there is a certain quantity of electricity, and by friction the equilibrium is disturbed, there is a tendency in the electricity either to leave the excited body for other substances, or to enter it. On this supposition had been founded the theory of positive and negative electricity, the former denoting the accumulation or redundancy of the fluid, the latter its deficiency. By whatever terms we may designate the phenomena, the two states have opposite effects, or possess different properties. Thus the sealing-wax, according to the state of the feather, either attracts or repels it; but while it remains in the same electrical state, the glass tube has directly the opposite effect on it. Whenever the wax repels, the glass attracts it. This opposite effect of these two substances was first observed by Dufay, and called by him, from the two substances in which he observed it, vitreous (that is, glassy) and resinous electricity. On this theory it was supposed that there are two fluids, which seems more open to objection than that of Franklin, which supposed there is only one fluid, and that this existed in different states. To these he gave the names of positive and negative. Without at all entering into these theoretical inquiries, further than to remark that the cause of the electrical effects is quite unknown, these terms, as very useful, may be retained.

The most important fact resulting from this observed repulsion and attraction is, that bodies similarly electrified repel each other, while bodies differently electrified attract each other. The bo-

dies which are repelled by glass are similarly electrified, and if other substances also produce repulsion they are similarly electrified. In the case of the feathers, when one is electrified by the sealing-wax rubbed with flannel, and the other by the glass rubbed with silk, it is found that they are in opposite states of electricity. It is found, also, that the substances employed for rubbing are also in an opposite state of electricity with the things rubbed. Thus the silk with which the glass is rubbed possesses the same electricity as the wax, and the flannel will possess the same electricity as the glass. These two states are always coexistent, or one cannot be excited in the thing rubbed without the other being sensible in the rubber. It is impossible to disturb the equilibrium of the electric fluid without producing both these states in some bodies or in others. The term positive electricity is applied to the glass rubbed with silk, the electricity leaving the silk and entering the glass: the term negative electricity is applied to the wax rubbed with flannel, electricity being supposed to leave the wax and enter the flannel. The effects of these states are the same, so that neither can be distinguished by any peculiar properties, nor does either seem inherent in the particular substance. A piece of wax rubbed with tin-foil becomes positively electric, and a piece of glass first made rough by scouring paper and then rubbed with flannel, exhibits the phenomena of negative electricity. A glass tube, rough at one end and smooth at the other, exhibits both states of electricity when rubbed. For all electrical experiments a dry atmosphere is necessary, and an atmosphere loaded with vapours, like that of a lecture room, where many persons are assembled, makes it difficult to perform many of the common electrical experiments. Each of the substances in the following list becomes positively electrified when rubbed with those which follow it: CATS'-SKIN, POLISHED GLASS; WOOLLEN CLOTH, FEATHERS; PAPER, SILK; GUM LAC, ROUGH GLASS. A suspended feather is very convenient for discovering when a substance is electrified, and little instruments called electrometers, or electroscopes, have also been invented for the same purpose. That invented by Mr. Bennet is, on the whole, perhaps as convenient a one as any. In it slips of leaf gold are suspended by a brass cap or wire, in a glass cylinder. When not electrified, these slips hang in contact, and they diverge the instant they are electrified. The divergence does not give any information as to the state of the electricity, and we can only know this by bringing some body to the electrometer, the electrical state of which we know; when if it be the same, the divergence will increase, if opposite the divergence will be diminished. Pith balls are also employed as electrometers; but the gold leaf, when smaller than the one on the table, which was large for the purpose of exhibiting the effects to the spectators, is a very delicate instrument.

There is a difference in bodies as to the manner in which they communicate electricity; some communicate it through their whole surface, which is particularly the case with the metals, and these are called conductors; in glass, on the contrary, the electricity was confined to that spot on its surface which received it: this was a non-conductor. Non-conductors served the purpose of isolating other bodies. It is on this principle that many electrical instruments are placed on a glass stand; and as glass is likely to attract and condense moisture, the glass is frequently covered with a coating of wax. In general conductors do not become electric by friction, and are called non-electrics; the non-conductors, on the contrary, do become electric by friction, and are called electrics. In this distinction there is, however, a fallacy: the electric fluid escapes

through the conductors into the earth or into other bodies, and no action is produced. If such bodies are isolated they are rendered electric. Non-electrics are merely good conductors; and metals are some of the best conductors. After the metals some neutral salts are good conductors. Water is an imperfect conductor, while resinous bodies, glass, and porcelain, are non-conductors. Air is a non-conductor, and seems, moreover, to retain the electricity in bodies by its pressure. In the vacuum of an air-pump an electrified body loses its electricity. Electricity is confined to the surfaces of bodies, and there is as much in a hollow cylinder, or globe, as if it were solid. Electricity, therefore, belongs wholly to the surfaces of bodies. There is no constant relation between the particular form of bodies and their conducting powers. Among solids metals are good conductors, but gums and resins are non-conductors. Among fluids, alkaline and acid solutions are good conductors, while oils are non-conductors. Solid wax is a non-conductor; and, when melted, wax is a good conductor. Cold glass is also a non-conductor, and red hot glass a conductor. Bodies in the most opposite states are conductors: flame and ice are both good conductors. Mineral bodies in a crystallized state are good conductors, and when merely heated, such bodies exhibit electricity. There is one of these, the *tourmaline*, the electrical properties of which have been known almost as long as the electrical properties of amber, which, when heated, is strongly electrified.—This body is crystallized, and one end of the crystal has more faces than the other. It is remarkable, that whenever one part of this crystal is positive the other is negative, or in the opposite state, and in general the end with the greater number of faces is positive. But no general conclusion or theory can be drawn from this, for it is known that under certain circumstances this polarity is changed, so that the end which is at one time positive becomes at another negative. Another mineral of this description was *boracite*, which is always negative and positive on its different and opposite faces. There is always, then, a sort of balance of electricity, so that whenever some body or part of a body is negatively, some other body or part of a body is positively excited. These opposite electrical states are always such as to neutralize each other. In the common electrical machine there is two conductors; one receives the electricity of the glass cylinder, and the other the opposite electricity of the silk rubber; one conductor is consequently positive and the other negative, and if these two conductors be connected by any third conductor, as a metal chain, all electrical phenomena cease. The equilibrium is interrupted only to be instantly restored. The professor then proceeded to describe the electrical machines which are represented in our plates. The first consists of a glass cylinder, A, about ten or twelve inches in diameter, and fifteen to twenty inches in length, turning between the two upright pillars B B, fixed to a stout mahogany base. Two smooth metal conductors, C C, equal in length to the cylinder, and about one-third of its diameter, are placed parallel to it on two glass pillars, D D, cemented into two sliding pieces of wood, so that their distance from the cylinder can be adjusted. F is a cushion attached to one of the cylinders, and to it is sewed a flap of oil silk, G. The conductor to which the cushion is attached is the negative, the other collects the electricity of the glass, and is the positive conductor. H is an adjusting screw. I a handle, K a multiplying wheel. The machine should be kept perfectly dry and clean. The other machine consists of a circular glass plate, A, mounted on an axis, and rubbed by two pair of cushions, as at B B. The brass conductor C has its points opposed to the plate, and is insulated by the glass stem D.

E F are double pieces of oil silk: There is a mahogany frame to the whole, and the plate is turned round by the winch F. To enable either of these machines to collect much electricity, it must be connected with the earth, which is easily done by a chain conductor. When the machine is in good order, and the plate or cylinder is turned, flashes and sparks of light, accompanied by explosions, are seen passing from the cushion and glass to the conductors, and for every spark that passes on one side there is a corresponding spark on the other. Sometimes, when the machine is in good condition, the sparks are some feet in length. If these sparks are conducted through ether they set it on fire, though to our sensations they offer, when taken on the knuckle, only a slight prickly sensation, producing inflammation. The appearance of the light is modified by the medium through which it passes, being in the atmosphere bright, while in rarefied air it acquires a reddish tinge, and in very highly rarefied air it assumes a greenish colour; in the most perfect vacuum we can produce it is green, and scarcely perceptible. As it is well known that by compressing air we can produce a flash of light, it has been supposed that electrical light is similarly produced. The stream of electricity either compresses the air and elicits a spark, or ignites it in passing through it.

ANIMAL HEAT.

[We have to apologize to our Correspondent for having so long overlooked his letter. It fell out of our view, or it would have been before inserted.]

To the Editor of the Chemist.

Mr. Editor, — I have read the article on Respiration and the production of Animal Heat in your 21st Number with attention: but it appears to me to be one question whether the cause of animal heat depends on respiration or the action of the brain, and to be another and very different question, what is the cause of animal vitality, or life. Both these questions being of great interest and importance, I propose to consider the first of them, reserving the other for some future opportunity. I shall divide my present remarks under the following heads of inquiry, namely, 1st. Is oxygen absorbed by the blood? 2dly. Does its combination with carbon produce heat? 3dly. If so, where does the combination take place? and 4thly. Is this, or is the action of the brain, the sole or chief cause of animal heat? Whether the nitrogen of atmospheric air be absorbed by the blood, and what is the use of it, appear to me quite foreign to any of the foregoing considerations; though I think that, if the oxygen of the air be absorbed, it may reasonably be presumed that the nitrogen is absorbed also, and for an equally useful, though a very different purpose.

As to the first of the above questions, whether oxygen be absorbed by the blood, this fact seems to be put beyond all doubt by the experiment of Dr. Godwin, who opened the chest of a living dog, and exposed the lungs and heart to view, when it was observed that the black or venous blood, on its return from the lungs, in its passage to the heart, changed to a bright vermilion colour. When the animal became exhausted, the lungs were inflated by artificial means, and the same effect was produced; but when this was omitted the blood received by the heart was black, and in a short time its action ceased.—*Philosophy of Medicine.*—Other proofs of the same fact are, that black venous blood, exposed to the air, becomes red on its surface; and air, confined over venous blood, loses its oxygen, and becomes unfit for combustion. According to Lavoisier, a man generally consumes 32 ounces troy of oxygen gas in 24 hours.

2dly. Whether the combination of inhaled oxygen with the carbon of the venous blood produces heat? It is well known that combustion, and even sometimes detonation,

accompanies the union of substances having a violent affinity for each other. The most remarkable instance of this sort is, that if potassium be thrown upon water, combustion, explosion, and flame immediately ensue, in consequence of the powerful affinity which the potassium has for oxygen. It immediately decomposes the water, unites with the oxygen of it, sets the hydrogen free, and a solution of pure potass, or oxide of potassium, is the result. So potassium in its combination with arsenic and tellurium produces heat and light by their mutual chemical affinity. Other acids than the carbonic are the products of combustion, as the phosphoric and sulphuric; but carbon or charcoal, from its affinity for oxygen, will decompose nitric acid, and, uniting with the oxygen of it, form carbonic acid, at the same time exhibiting a beautiful flame. Now, as nitric acid is composed of oxygen and nitrogen, and the atmospheric air is composed of the same ingredients, (the oxygen only being in larger proportion in the acid,) and as the blood, in passing through the lungs to take up the oxygen, throws off carbonic acid gas (which is composed of carbon and oxygen,) in larger proportion than could have been furnished by the atmospheric air, no other proof seems necessary to establish the position, that the combination of inhaled oxygen with the carbon of the venous blood produces heat and combustion.

But the third and next question, *where* the combination takes place, it must be confessed, is more difficult of solution; and I express my opinion upon it with more diffidence, as it is, in contravention with that of Dr. Edwards, which you seem to have (though certainly not with any degree of positiveness or confidence,) adopted. You say that the theory of animal heat being produced by the union and combustion of the carbon of the blood with the inhaled oxygen of the atmosphere, is assisted by supposing that the oxygen is absorbed by the blood, and gradually combined with the carbon of it in its circulation through the veins; but is inexplicable if the union is supposed to take place entirely in the lungs. You do not, however, enter into any particular explanation of the grounds on which you have formed this opinion, though you notice objections which have been made to it. The following appears to me to be some explanation of a contrary doctrine:—It is the venous blood which is supposed to contain carbon; and this blood is carried to the lungs, where it meets with the oxygen of the atmosphere, and is prepared anew for circulation. Now, is it not more reasonable to conceive that the combustion which takes place is on the first contact of the carbon of the venous blood with the oxygen in the lungs, than after a passage of the oxygen through the arteries to the veins? Is there not a greater difficulty in conceiving combustion to take place in close receivers, like the veins, than in open ones, like the lungs? Besides, when once contact and combustion take place between two substances which have an affinity for each other, what is to make this combustion gradual and lasting? especially if it be considered as taking place in all the different parts of the substance supposed to cause or support the combustion at the same time? which is, I imagine, the supposition with regard to all the blood in the veins. Or, if it be supposed that the combustion, though gradual, wholly takes place on the entrance of the absorbed oxygen into the veins, is not that theory as difficult of explanation, at least, as that which supposes it all to take place in the lungs? But, though I have a difficulty in conceiving how combustion can be carried on through the veins, I have none in supposing that, by the decomposition of atmospheric air at the lungs, caloric is evolved, which is taken up by the arterial blood, and so communicated to the blood in the veins, and diffused throughout the ex-

treme vessels of the body, so as, in some measure, at least, to account for its uniform temperature.*

The fourth and last question I have proposed to consider is, whether the combustion supposed, or the action of the brain, be the sole or chief cause of animal heat. It is a strong and notorious fact, in support of the former supposition, that the habitual temperature of any animal is high in proportion as his respiration is active; and it is equally so, that an accidental increase of the activity of respiration, as by walking up a hill, or running, likewise increases the heat of the body. Mr. Brodie's experiment does not appear to me to furnish any ground for the conclusion he is said to have drawn from it, namely, that the production of animal heat is owing to the action of the brain, and not to respiration. He certainly did not expect that the animals on which he operated would continue to live as long and as well after they had lost their heads as they had done before! He found that the circulation of the blood was kept up, and carbonic acid gas formed by the artificial inflation of the lungs, for a time, as Dr. Godwin had before done, in his experiment already noticed. Was not that some proof that respiration had some influence on animal heat? and was it any cause for wonder that that heat rapidly diminished? But the experiments of M. Le Gallois seem to put the fallacy of Mr. Brodie's conclusion beyond a doubt. I shall therefore only add, that with great diffidence in my own opinion, it seems to me, that although Mr. Brodie's view of this question, that heat cannot be referred to the combustion of the inspired oxygen, had been correct, it does not follow that the question must depend exclusively on the principle of vitality; for it is perfectly clear that vitality, or life, is by no means necessarily and universally connected with heat, as is evident from cold-blooded animals (frogs) having been frozen so as to chip like ice, and afterwards thawed and restored to life.

To conclude, I perfectly subscribe to the opinion of Mr. Bell, who, in his System of Anatomy, vol. ii., has denied that animal heat is preserved *solely* by respiration; but I think that of M. Despretz equally correct, that animal heat is preserved *chiefly* by that cause. Mr. Brodie's experiment, indeed, demonstrates the accuracy of both these opinions. But with all the unfeigned respect I bear to those two learned persons, I do not think it needs any ghost from the grave to convince us that animals will not live as well without heads as with them, though we know that some animals manage to live a long time, and well, with heads as little furnished as may be.

Aug. 7. PHILO CHEMICUS.

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* Our Correspondent states, that the effect of oxygen on the blood in the lungs is to change its colour; and as Sir H. Davy, long ago, found that this takes place when pure oxygen is employed, without the bulk of the gas being sensibly diminished, or carbonic acid gas being formed, it would appear, that the separation of the latter gas from the blood in the lungs, is not essential to the change of colour which there takes place. Arterial blood is gradually changed into venous blood, in its progress through the body; and one of the elements of this change is, probably, the gradual disappearance of oxygen and formation of carbonic acid gas, and the consequence of this latter formation, the development of heat in every part of the body. If the whole quantity of oxygen absorbed was converted into carbonic acid gas in the lungs, this gas being immediately *expired*, a much greater degree of heat would exist in the lungs than in the other parts of the body; and we cannot form the least notion "how the *caloric evolved should be taken up by the arterial blood*" more than by all the surrounding membranes, "and so communicated to the blood in the veins." Notwithstanding our Correspondent's acute objections, we must still think, that the union of the carbon of the blood with the oxygen inspired, and consequent formation of carbonic acid gas, does not take place wholly in the lungs, but at every point of the vessels in which the circulation of the blood is carried on, and at every part of the body.

NEW APPLICATION OF MECHANIC POWER.

A Mr. Ruthven, of Edinburgh, has adapted a mechanical principle, before known, it is said, and put into practice in some cases, to a new form, so as to produce a simple, useful, and powerful machine. We take the following description of it from the *Scotsman*:—

"Let the reader conceive an iron pinion, driven by a winch, and revolving vertically, and a wheel of the same metal, in the same position, with its rim resting on the pinion, and revolving by means of the contact or friction of the surfaces. In this position they exactly resemble the wheel and pinion of a common crane, except that they have no teeth. Suppose the wheel to have its axis placed, not in the true centre, but a little on one side of it, so that the radii (or spokes) of the one side are an inch shorter than those of the other. It is plain, that if we begin where the shortest radii are in contact with the pinion, and make the wheel revolve half way round, the longest radii will then take the place of the shortest, and the axis of the wheel will be pushed or protruded one inch farther than it was from the axis of the pinion. It is this protrusion by the motion of an excentric wheel that constitutes the mechanical power of Mr. Ruthven's machine. The axis of the pinion turns in a fixed box or gudgeon, while the axis of the wheel is allowed to move up and down within a longitudinal aperture; and by means of iron rods or pillars resting on the latter axis, the pressure is transferred to a platform in the upper part of the frame, and may be there applied to any purpose.

"Mr. Ruthven varies the form of the wheel according to the object he has in view. In some cases it is elliptical, in some spiral, in others it has a heart shape, and in others he employs, not an entire wheel, but a sector embracing 50 or 60 degrees. And though the motion of the pinion is communicated to the wheel by the contact of their surfaces merely, yet where the excentricity is great, he adds teeth for security.

"The mechanician will easily discover, that the power in this machine is essentially that of the inclined plane. If, from the axis of the excentric wheel, we describe a circle touching the circumference on the inside at the shortest radius, it is evident that the crescent which lies between this circle and the exterior circumference, may be considered as a wedge, which in the course of the revolution is intruded between the two moving bodies, and forces the one to recede from the other. Now the superiority of this modification of the inclined plane over those in common use, seem to be chiefly these:—1. The principal portion of the friction is that of *rolling*, which in the case of metal on metal, is probably not the twentieth part of the friction of *sliding*. The portion of the friction consisting of *sliding*, is that of an axle within its gudgeon, which of all kinds of sliding friction is the smallest. 2. As compared with the screw (and we may add, the hydraulic press,) it has this grand advantage, that the power admits of every degree of graduation, while that of the former is perfectly uniform. Suppose, for instance, we work with a screw to compress cotton into small hard packages for exportation. Then since the resistance increases in a very high ratio as the compression proceeds, we may begin with one man, but we shall ultimately need to employ ten, because the power of the screw is no greater in the last stage than in the first; but, with Mr. Ruthven's machine, we accomplish that by the graduation of the power, which in the other case can only be effected by an increased application of human strength. By varying the curvature of the wheel, we can multiply the power so, that the same application of human force, which produces a pressure of two tons in the first stage, shall produce one of a hundred tons in the last. 3. This accumulation of power, which is of inestimable importance

in many cases, is sometimes effected by a combination of levers. But over such combinations, Mr. Ruthven's excentric wheel has these advantages: first, that the mechanism employed is decidedly simpler, and the friction undoubtedly much less; secondly, that the elasticity, which often defeats the efficacy of combined levers, is completely obviated; thirdly, that we can vary the degree and measure of gradation in any way, with much greater facility; fourthly, the machine can be so formed, that its motion shall be constant and progressive, without stops or backward movements, as in the case of levers. It is hence much better adapted for use where steam or water power is employed. As a proof of its superior simplicity, we may mention, that a species of press for bookbinding, which Mr. Ruthven formerly made with levers, he now makes with this excentric wheel, at two-thirds the original price. Our impression is, that for stamping, coining, and punching, the machine will be found decidedly superior to every other now in use. Indeed, the inventor thinks, that scarcely any task can be proposed to him which he is not able to perform. He is preparing an engine at this moment for punching, by mere pressure, holes of an inch square through bars of cold iron five-eighths of an inch in thickness, by the strength of a single man.

"With regard to the power of this machine, it may be estimated thus:—

"Supposing a man, who pulls with a force of 30 pounds, to turn a winch of 15 inches radius, on the axis of which is a pinion of two inches in diameter, operating on a spiral wheel six feet round, and of half an inch of excentricity, (which gives an inch of protrusion) then the effect will be as follows:— $30 \times 15 \times 72 = 32{,}400$; that is, supposing the excentricity to be perfectly uniform, a constant pressure would be produced equal to 15 tons, or a body 15 tons in weight would be lifted one inch: but by making the excentricity vary at different portions of the circumference, the pressure may be made ten times as great as here supposed at a particular point. It is scarcely necessary to add, that in this case it operates only through a tenth part of the space."

CHEMICAL SOCIETY.

We are informed, that the Lecturer at this Society, whom we mentioned in our 32d Number, was a Mr. Austin, and not Davies, as he is there named. The inauguration of the Society is to take place on Nov. 11, and not on Nov. 9. Dr. Birkbeck will, on that occasion, deliver a lecture, explaining the objects of the Society and general principles of the science. Tickets of admission may be obtained, we believe, through the Members, who are requested to apply for them to the Secretary, Mr. Jones, 55, Great Prescot-street.

TO CORRESPONDENTS.

If a Young Chemist applies to Mr. W. Jones, 55, Great Prescot-street, he will, probably, attain his object. We do not know to what the latter part of his note alludes.

Mr. Jones's communication came too late to enable us last week to make the correction he pointed out.

We are sorry that Philo Chemicus and A Stone should have reminded us at this moment of our neglect, as it takes from us the merit which we really possess, of having intended to remedy it without being reminded. More than three weeks ago his paper was selected for publication, with that apology for omitting it before which still accompanies it. The conjecture of A Stone is ingenious; but we should prefer, with the author's permission, retaining it till some circumstance makes the matter momentarily interesting, and therefore more fit for publication. The *Mechanics' Institution* is in Southampton-buildings, Chancery-lane; the *Chemical Society* meets in Aldermanbury. Which does Philo Chemicus mean?

A Friend's request came too late to receive an answer this week.

H. W. W. has our thanks for calling our attention to an obnoxious passage in The Chemist.

*** Communications (post paid) to be addressed to the Editor at the Publishers'.

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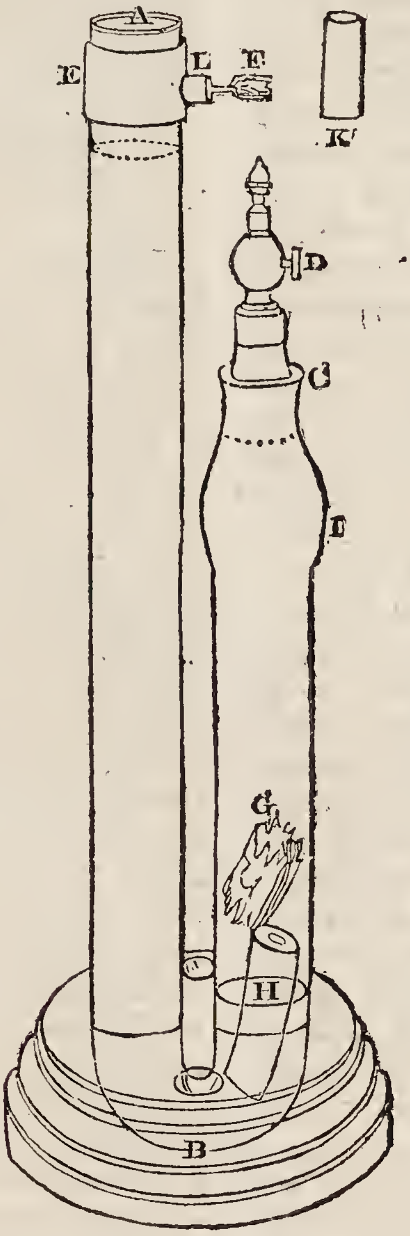
The Chemist.

No. XXXV.] SATURDAY, NOVEMBER 6, 1824. [Price 3*d.*



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DR. FYFE'S HYDRO-PNEUMATIC LAMP.

(*From the Edinburgh Philosophical Journal.*)

It consists merely of a bent glass tube A B C, the internal diameter of which is nearly an inch. It is open at both ends; fixed into a wooden stand B. The short limb C is five, and the long one A eight inches in length. To the mouth C there is ground a glass tube, to which is fixed a stop-cock D. At E there is a brass ring fitted closely

to the tube, and from which there proceeds a piece of brass, to which the spongy platinum F is fixed by *very fine* wire.

As the platinum loses its power of ignition by exposure to air, or rather requires a large supply of hydrogen, I have it covered with a cap, represented by K, and which is ground accurately on the cylinder L. When the lamp is required for use, a piece of zinc is put into the short limb as at G, and which is prevented from coming nearer than about an inch from the bending, by a tube of glass as at H. Diluted sulphuric acid is then poured in, so as to fill as far up as I, after which the stopper and stop-cock are introduced. By the action of the acid on the metal, hydrogen is generated, which fills the short limb, and raises the fluid in the opposite one: and the production of gas ceasing when the acid gets below the zinc, there is thus always a supply of gas subjected to the pressure of a column of fluid of from six to seven inches. When the stop-cock, therefore, is opened, the hydrogen is propelled against the platinum; the fluid falls into the short limb; and as the zinc is thus again surrounded by acid, more gas is generated to serve for the next time. The distance of the platinum depends on the size of the bore of the stop-cock; but as the ring E is moveable, it can be easily adjusted.

The apparatus described contains only about a cubic inch of gas; but I find it is sufficient for affording a light; for though it does not ignite the platinum long enough to kindle the gas, yet there is sufficient heat to set fire to a sulphuric match. The moment, then, that the platinum becomes red hot, a small sulphuric match must be applied to it. The only circumstance to be attended to, is to allow the match to remain ignited for a few seconds, with a view of driving off any sulphur that may be left adhering, and which prevents the ignition when the gas is again impelled on it. I would therefore recommend that, each time it is used, the flame of the match be kept at it for a short time.

I am aware that many improvements on this lamp might be suggested, and which, it must be admitted, would make it more complete, but they detract from one of its greatest qualifications, cheapness; the lamp, as described, being purchased for about ten shillings.

LECTURES ON CHEMISTRY AT THE ROYAL INSTITUTION.

ELECTRICITY.

LECTURE 9. In my last lecture, said Mr. Brande, I treated of the most common, but not the least important part of the phenomena of electricity: the mode of exciting it in bodies by friction. I showed to you, that when it was excited they attracted and repelled light substances; that this power resided only in the surfaces of bodies; that those similarly electrified repelled, and those differently electrified attracted each other; and that the different electrical states does not depend on the nature of the bodies, but on the mode of exciting the electricity. It is nothing inherent in them, but is the result of the manner employed to produce it, which is supposed to destroy the equilibrium of the electrical fluid, as much being excited in one object as leaves some other or the surrounding objects, and the two different electrical states being always such as exactly to counterbalance each other. To produce electricity in any quantity, it is necessary to establish a communication between the substances to be electrified and the objects around. All these appearances and phenomena have been explained, by the hypothesis of Franklin, on the supposition that there is but one fluid, which is rendered by the excitation redundant or positive in some substances, while it leaves, or is negative, in some others. The two states of the fluid have therefore been called positive and negative electricity; but it must be acknow-

ledged that there are some circumstances not easily explicable on Franklin's hypothesis. The other hypothesis, that of Dufay, supposes the existence of two distinct fluids; and this hypothesis is now generally adopted in France. Having established the general fact by numerous experiments, of the existence of the two electrical states, it is perhaps of little consequence on what theory we explain them. There is, however, no means of distinguishing one state from the other but by the test of some substance, the electrical state of which we know. When we find, for example, that a substance imparts electricity to a pith ball, and afterwards that this pith ball is repelled by sealing-wax rubbed with flannel, which we know to be negatively excited, we infer that the other body has also been negatively electrified, and has imparted this species of electricity to the ball.*

After this summary of his former lecture, Mr. Brande proceeded to describe what is called *electricity by induction*, electricity by position, or induced electricity. When a conductor is placed in contact with the prime conductor, and the machine is worked, it is electrified in the same manner as it; but if the prime conductor, which is insulated, have another conductor, not insulated, opposed to it, and a thin stratum of some non-conducting substance, such as air, glass, &c., be interposed between them, the second conductor becomes electric by what is called induction. In this case, however, it is remarkable that in the second conductor a polarity is produced, and the end nearest the prime conductor becomes differently electrified from it, and the further end similarly electrified. If a third conductor be placed near the second, the former being connected with the earth, and the latter insulated, the same effect ensues: it becomes electrified, and has the same sort of polarity as the second; that is, the end nearest the second is in an opposite state of electricity, and the further end in the same state. It is only necessary that the last of a series of conductors thus placed be connected with the ground, while the rest are insulated, and they may be multiplied to any extent, the same phenomena being produced in every conductor throughout the series. Each conductor will be polarized, and will exhibit different states of electricity from the one immediately preceding it. There is, then, a great difference in that electricity communicated by the contact of conductors and that communicated by induction. In the former case they are all electrified in the same manner as the prime conductor; in the latter they are each polarized, and exhibit opposite states of electricity. That this is the case may be proved by the insertion of an electrometer at each end of every conductor, and it will be found that each end is in an opposite state of electricity from the other end of the same conductor, and from the end next it of any other conductor. It may be proved also by approaching the conductors, so as to take a spark from each, which only takes place when the electricity is in an opposite state. It is on this principle that a number of

* There does seem a positive difference between the two states, though it is not perceptible to our touch or our sight. Dr. Wollaston transmitted a current of electric sparks, by means of two fine gold points, along the surface of a moistened card tinged with litmus, and placed between the points. After a few turns of the machine, a *redness* appeared about the *positive* wire; by placing the negative wire on the spot, it was soon restored to its original colour. Hence it appears, that the effect of an acid is produced by the positive wire, and that the opposite electricity counteracts this effect.—*Edin. Encyc.* Art. Electricity.

More lately Berzelius has stated, that positive electricity has the taste of an *acid*, while negative electricity is more acrid and *alkaline*.—See *The Chemist*, vol. i. p. 424.

At the same time, it must be observed, that these effects may be explained without it being supposed that the peculiar taste or the colours produced are certain indications of a difference in the electricities.

electrical toys are constructed. If small spangles of tin foil be pasted on a clean plate of glass, at a small distance from each other, each of them will represent an insulated conductor, and on holding the first spangle near the prime conductor, and connecting the last with the earth by the hand or any other means, a series of brilliant sparks passes between each piece of tin, displaying in a dark place a stream of light of the exact form of the tin. The professor exhibited this experiment with an electrical toy, called the spiral luminous tube, of which we shall hereafter give a copy. The state of the atmosphere was extremely damp, and did not allow him to show a similar experiment with a plate of glass, in which pieces of tin were disposed in the form of words. It is, however, plain, that when circumstances are favourable, any kind of words, or flowers, or figures may be made to appear in a dark room, greatly to the astonishment and perhaps the terror of those not acquainted with the secret. If a plate of glass, which is a worse conductor than air, be interposed between the conductors, the accumulation of electricity in each conductor, and its polarity, will be increased, because the glass does not allow that equilibrium to be so speedily restored, which we see constantly taking place through the air. A plate of glass itself becomes electric by induction, and one side of it, when held to the conductor, becomes positive and the other negative. It was formerly supposed that this was merely a passage of electricity from one side to the other, but it would now appear that the phenomenon is not so simple. The side held to the conductor becomes positive, while the opposite side becomes negative, being connected with the earth by induction. It is on this principle that the Leyden phial is constructed. If the plate of glass, instead of being clean, is coated with tin foil, that serves to charge every part of the surface of the glass, or to spread the electricity over every point. Uncoated, it could only be fully charged by carrying every point of the glass to the conductor, and only discharged by moving the discharger to every point on its surface. The Leyden phial is in principle only a plate of glass, having its two surfaces coated to a certain extent with metal, but formed into the shape of a bottle. On its being connected with the conductor, the interior becomes positive and the exterior negative; and as glass thus coated allows of a great accumulation of electricity, what is called charging the phial merely consists in spreading the positive electricity over every point of its interior to a certain height, while the exterior becomes negatively electrical by its contact with the earth. In this state, if the two surfaces are connected by a good conductor, the equilibrium is restored, and a spark, brilliant in proportion to the quantity of electricity, is perceived. The professor made several experiments to show the mode of charging the phial, and that the effect was precisely the same with a plate of glass coated over a portion of its surface with tin foil and a Leyden phial. To discharge this instrument, a discharging rod is used, which consists of a pair of brass compasses or tongs, with a knob at each end, and a glass handle, so that the person who operates the discharge is insulated by the non-conducting medium. This is necessary, for the electric shock, when taken, excites a jarring and peculiar sensation: if it be somewhat strong, it affects the breathing; if more powerful, it suspends for a time the action of the heart; and when still stronger excited, it causes instant death. This is what happens when a person is struck by lightning, which is a natural, but exceedingly violent electrical shock.*

* We may here give two instances of persons killed by lightning. One occurred long ago, and possesses a peculiar interest, from death having been occasioned by making electrical experiments;

In constructing all electrifying machines, care must be taken to remove every kind of asperity from their surfaces, otherwise the

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the other is likewise interesting, from the care taken to examine the body:—

"Professor Richman, of St. Petersburgh, was engaged in a work on the electricity of the atmosphere, and was therefore extremely desirous of observing the electrical state of the air during thunder storms. On the 6th of August 1753, he had prepared his apparatus for observation. From a metallic rod passing through a perforated bottle, and fixed upon the roof of his house, there passed a chain surrounded with electrics. The other end of this chain was fixed to another metallic rod placed in a glass vessel, and to this second rod was attached a linen thread, which marked, by its elevation on a quadrant, the intensity of the electricity of the rod. While he was attending an ordinary meeting of the Academy of Sciences in the forenoon, his attention was excited by the sound of distant thunder. He immediately set off for his own house to observe the electrical state of the air, and took with him his engraver Sokolow, that he might be enabled to give a better representation of any phenomena that should present themselves. Richman remarked, that the thread pointed to four degrees on his quadrant; and while he was describing to his friend the dangerous consequences that might ensue if the thread rose to 45°, a dreadful clap of thunder alarmed all the inhabitants of St. Petersburgh. Richman inclined his head to the gnomon to see the degree of electricity which was indicated, and when he was in that bent posture, with his head about a foot distant from the rod, a large globe of white and bluish fire, about the size of Mr. Sokolow's fist, flashed from the rod to his head, with a report as loud as that of a pistol. The professor fell back upon a chest behind him, and instantly expired. Sokolow was stupified and benumbed by a sort of steam or vapour, and was struck by several fragments of the red hot wires; and the moment he recovered he ran out of the house, acquainting every person whom he saw with the accident. In the mean time, Mrs. Richman, who heard the stroke of thunder, hastened to the chamber, and found her husband without any appearance of life, in the attitude of sitting upon the chest, and leaning against the wall. The house was filled with a sulphureous vapour; an English clock was stopped in an adjoining room, the ashes were thrown from the fire-place, and the door-posts of the house were rent asunder. As soon as medical assistance was obtained, a vein of the professor's body was opened, but no blood flowed, and every attempt to restore life by violent chafing, and other means, were wholly fruitless. When the body was turned upside down, a small quantity of blood fell from the mouth during the rubbing, and on the forehead appeared a red spot, from the pores of which some drops of blood oozed, without wounding the skin. The shoe on the left foot was burst open; and below the aperture there was a blue mark on the foot, from which it is probable that the electricity had issued. Several red and blue spots, resembling leather shrunk by being burnt, appeared on the left side, on the back, and on other parts of the body. The stocking was entire at the place where the shoe was burst, and the coat had received no damage. The back of the engraver's coat, however, was marked with several long and narrow burnt stripes. Upon opening the body 24 hours after the accident, the cranium and brain were uninjured; some extravasated blood appeared in the cavities below the lungs, and in the lungs towards the back, which were of a brownish-black colour. The throat, glands, and the thin intestines were all inflamed, but none of the entrails were touched. The singed leather-coloured spots, merely penetrated the skin; and 48 hours after death the body was completely corrupted. It is a curious circumstance, that Professor Richman had in his left coat pocket 70 rubles of silver, which were not in the least degree affected."—*Edin. Encyc.* Art. Electricity.

"Two vehicles were passing along a narrow road embedded in a forest: in the first were two brothers of the name of Teele, one aged 33 years, the other 29; in the second was M. Teele the nephew, aged 23 years, and M. Decker. The lightning struck successively the first horse, the two brothers, M. Decker, and his companion; the last did not survive. The horse remained dead on the spot: the skin on the lower part of its belly was torn, the mouth open, and the teeth black.

"The lightning passed to the younger Teele by his umbrella, which, with his watch, was thrown 24 steps off; the vehicle had a hole made in it six inches in diameter. The body, carried to the nearest village, was put into a warm bath and rubbed; blood flowed from the nose, mouth and ears, but no signs of life appeared. The mouth and nose were black; the skin and muscles of the arms and hands, both of which held the umbrella, were furrowed to the bone; the sleeves of his clothes were torn; the lesions of the skin were not like those produced in burns; the skin appeared as if it had been raised by rapid rubbing,

electricity will constantly pass off. A point held to the conductor acquires an opposite state of electricity, and rapidly discharges it, giving a sensation of a strong current of air, which has been called the electrical aura, and is, in fact, the air about the point brought into rapid motion. Knobs are necessary to exhibit the sparks and communicate shocks, for points draw off the electricity without exhibiting it. The electricity may thus be discharged from a Leyden phial quietly, without producing any explosion. The current of air which proceeds from points has given rise to several moveable toys, the principle of which is to expose wheels or vanes to this current, and thus set a variety of little instruments in motion. The quantity of electricity, or relative charge, which any substance or jar has received, is ascertained by an instrument called an electrometer, and that invented by Mr. Henley is one of the best. It consists of a rounded metallic stem, with an ivory semicircle, which is graduated, and to the centre of which a thin piece of cane or ivory is fixed by a pin, so that it can freely move. The piece of cane has a pith ball at its lower extremity, which, when not electrified, hangs parallel to the stem, but recedes when electrified, in proportion to the intensity of the electricity; and the rod passing over the semicircle shows to what degree the charge has reached.

Jars are charged by connecting one with another, and when two are differently charged they are both discharged by a connexion

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and the clothes bore no trace of burning, but seemed as if torn by a sharp point. M. Decker, who was in the same car, received at the same moment, a blow on the stomach so violent that he was thrown out, and remained insensible for half an hour. When examined, the place on which he felt the blow was found very red but unwounded; he very speedily recovered.

"The two brothers were sitting side by side when struck; the lightning first reached the head of the elder brother, tore his velvet cap into several pieces, glanced over the temporal bone about an inch above the left ear, then behind that ear, and flaying the skin slightly, descended to the neck; it traversed the nape of the neck obliquely, and ascended to the right ear, the interior of which was as if scratched; it then went by the right shoulder, beneath the chin, over the right breast along the arm, and returning to the back, descended along the vertebral column to the sacrum. In this last part of its course the skin was not torn, but only slightly raised and much reddened; marks of the same kind were across the arms, and with the torn clothes, showed the zig-zag path of the lightning as it had passed alternately from the right side of the younger brother to the left side of the elder. It continued its course on the former from the part where it had come in contact with some pieces of metal contained in his pocket, and at which place it had raised the skin of the muscles of the side, for a space as large as a hand; it then crossed the stomach to the left side, and passed over the internal surface of the thigh, knee, and calf of the leg. The width of the trace marked by the lightning, was generally about two inches; the wounds were most extensive and deep at the intersections of this trace; many of them were very painful, and suppurated abundantly; the skin had been closely rolled up on the right and left by the rapid passage of the lightning. The wounds did not bleed; and on healing, those phenomena only took place which accompanied the simple formation of the skin. Nothing indicated a lesion of the organs due to fire or heat, but the effect was just such as would have been produced by the passage of a bullet over the surface.

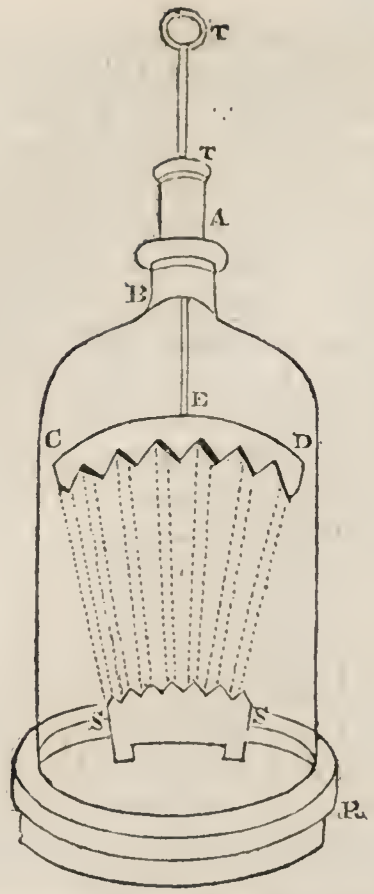
"The two brothers, on becoming sensible, felt excessively sick, and after drinking some tea, vomited several times, throwing out a little blood. No fever occurred. The eldest was quite deaf on the day of the accident, but recovered his hearing, in part, on the morrow. No paralysis occurred in the limbs struck by the lightning, and the wounds cicatrized in a few weeks.

"The accident happened in May, 1821. Twelve months afterwards, the elder brother remained affected by deafness, which varied with the weather; he had a strong tendency to sleep, and sometimes slept 24 hours, if not awakened. The younger, ultimately, had an inflammatory fever, and was subject to a periodical depression, of which he had previously felt nothing; and, generally, a much stronger impression had been made on the nervous system of both, than from the vigour of their constitution might have been expected." — *From Schweigger's Neues Journal.*

being established betwixt them. Jars may be charged in the same manner as the conductors were charged, and be made to exhibit a similar polar arrangement. If the first jar be connected by its internal surface with the positive conductor, another jar may be charged from its exterior coating, and if this be insulated, a third may be charged in the same manner, the glass in this case serving as the medium of induction. Dr. Franklin, to prove his own theory of electricity, suspended a phial from the conductor, and insulated the rubber of his machine, and found that it could not be charged, although his hand was constantly applied to it; for though the electric matter left the outside, there was none to be accumulated on the inside. On removing his hand, and connecting the outside coating and the insulated rubber by a conducting substance, the phial was easily charged, which justified his opinion, that the electric matter accumulated on the inside was derived from the outside of the phial. The coatings of jars, it could be proved, by having these coatings made moveable, served only to convey the electricity over the surface of the glass, and were not themselves electrified. When this was done, and the glass jar charged, they could be removed, and were found not to be electrical, while the glass gave as strong a shock as if they were not removed. The professor performed this experiment, but he replaced the moveable coatings before discharging the jar, because they establish the connexion between every part of the jar, which without them could only be done by drawing the discharging rod over every part of the jar. The professor concluded his lecture by describing the electrophorous of Volta, which has already been described in The Chemist, and the phenomena of which he ascribed to induction. By this instrument sparks may be produced for any length of time; and by the use of it Volta had constructed his lamp. A small quantity of hydrogen gas is put into a reservoir, and allowed to escape by the pressure of water on turning a stop-cock. In a box below the reservoir a small electrophorous is placed, and a wire passes through a glass tube from the upper part of the box to the small aperture. The cover of the electrophorous is raised when the stop-cock is opened, and the spark conveyed by insulated wire to the stream of gas instantly kindles it. The electrophorous Mr. Brande described as a convenient instrument.

DISCOVERY OF GALVANISM.

THE discovery of the effects of electricity on animals took place at the time from something like an accident. The wife of Galvani, at that time professor of anatomy in the university of Bologna, being in a declining state of health, employed as a restorative, according to the custom of the country, a soup made of frogs. A number of these animals, ready skinned for the purpose of cooking, were lying, with that comfortable negligence common to both French and Italians, which allows them without repugnance to do every thing in every place that is at the moment most convenient, in the professor's laboratory, near an electrical machine, it being probably the intention of the lady to cook them there. While the machine was in action, an attendant happened to touch with the point of the scalpel the crural nerve of one of the frogs, that was not far from the prime conductor, when the limbs were instantly thrown into strong convulsions. This experiment was performed in the absence of the professor, but it was noticed by the lady, who was much struck by the appearance, and communicated it to her husband. He repeated the experiment, varied it in different ways, and perceived that the convulsions only took place when a spark was drawn from the prime conductor, while the nerve was at the same time touched with a substance which was a conductor of electricity.—*Eloge de Galvani.*

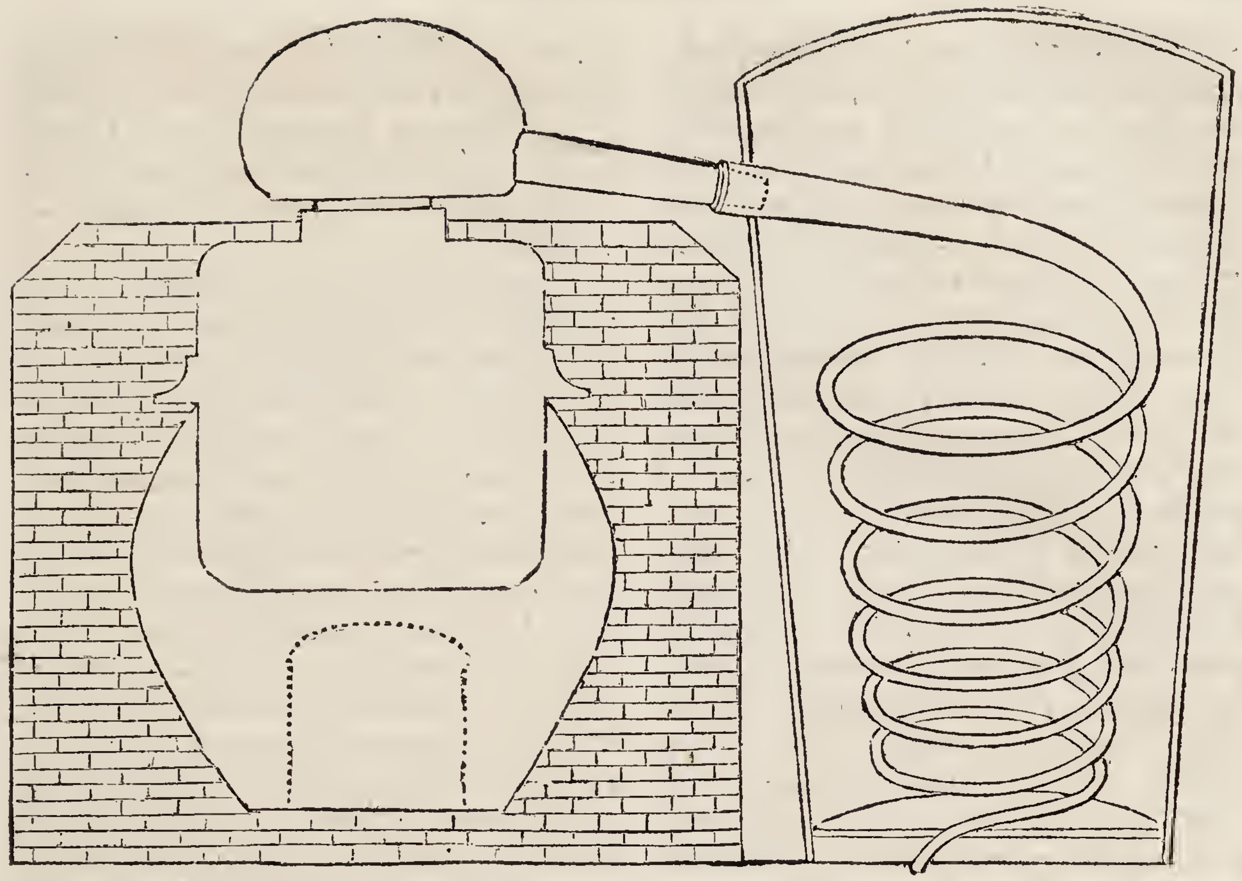


ARTIFICIAL AURORA BOREALIS.

THE following is the Abbé Bertholon's apparatus for imitating an Aurora Borealis:—R R is the receiver of an air-pump, and T T is a rod screwed into a pole E, in the crescent of metal C D, the lower surface of which consists of a number of angular projections; S S is a circular segment of metal, having corresponding angular projections, placed on the plate of the air-pump. If the receiver be exhausted, and the metallic shoulder A electrified, the whole of the receiver will be filled with a superb light, and columns of fire will dart from the angular projections in the crescent to those of the plate S S. It is supposed by philosophers, that the aurora borealis is an electrical phenomenon; and that this is both an illustration and a good imitation of the manner in which it is produced.

CUTTING OF STEEL BY SOFT IRON.

MESSRS. DARIER and D. Colladon have lately been examining the circumstance of cutting hardened steel by a thin revolving plate of iron, with a view of ascertaining the cause of the action of the iron, and they have read a Memoir on this subject at the Natural History and Philosophical Society at Geneva. They employed a wheel of soft iron, seven inches five lines in diameter, which was made to revolve by a large hand wheel; and the instruments they employed it to cut were engravers' *gravers* (*burins.*) As long as the circumference of the wheel did not move faster than 34 feet per second, the graver acted on the wheel with great facility; when it moved with a velocity of 34 feet, 9 inches, the graver was slightly attacked; and when the wheel moved at the rate of 35 feet, 1 inch, it decidedly attacked the steel. Between this and the velocity of 70 feet in a second, the effect constantly increased, and then the iron scarcely threw off any particles, while the gravers were attacked with the greatest violence. In the opinion of these authors, this effect is not occasioned by the softening of the steel by heat, for they observed that the iron attacked the steel without producing any heat when applied for a single instant, and that when heat was produced by a more continued or violent pressure, the steel was then broken in a different manner, and the action of the iron appeared less. The particles of steel which collect on the iron, though not necessary to the effect, augment it. On trying the experiment with a wheel made of copper, and one made of copper and tin, instead of iron, the steel was not at all attacked, even when the wheel revolved at the rate of 200 feet in a second; but the hard alloy glided over the bodies presented to it without producing any effect. At the same time, the copper wheel acted on some alloys, none of which were so hard as the steel. Files and steel springs were pressed for a long time against the copper wheel while moved with the greatest velocity, without, as the authors remark, producing the least sensible heat. They attribute the effect of the iron on the steel entirely to the mechanical force (*choc.*)—*Bib. Universelle.*



SPANISH STILLS.

Mr. Editor,—Having lately observed in your miscellany several articles on Distillation, and having lately met, in the course of my reading, with the following description and drawing of the still in use in Spain, I transmit them to you, thinking it may afford both instruction and amusement to your readers to see some of the practices of other nations.

I am, Sir,
Your obedient servant,
Oct. 2, 1824. A Traveller.

"The stills in general use in Spain," says Mr. Gordon, in answer to some inquiries transmitted to him by a Committee of the House of Commons, which sat in the year 1798, to inquire into the revenue arising from distillation, "with very few exceptions, differ very little in shape, being 33 inches diameter by 33 inches height in the sides, cylindrical from the bottom to the shoulder; the bottom deeper about two inches in the centre than at the sides; the cover, from the shoulder to the junction with the head, forming a dome nearly five inches higher in the centre. The head is in the form of a compressed globe, and the pipe, which connects it with the worm, joined on one side in the lower orbit, where a kind of gutter or canal is formed in the inside for the purpose of conveying the condensed liquor to the pipe. The worms, where they join the pipe, are about 2½ inches diameter, and taper a very little to the lower end, being about 15 feet long, in five circular turns, like a corkscrew, in the form of the annexed representation. The refrigerating vessels are generally a tub of from five to seven feet high, four to five feet diameter, some of them are placed in cisterns of brick and mortar. The furnaces are like an oven; the bottom of the still falling about a foot under the line of the dome, and placed about two feet from the ground on which the fuel is laid, without any grate, ash-hole, or stopper to the mouth of the furnace.

IMPROVEMENT IN ARTS.

We read in the *Bulletin des Sciences Technologiques* that the Emperor of Russia has established at Moscow a school for dyeing and preparing cloth. In this school are admitted 150 scholars, taken indiscriminately from all classes. They

are to pay 250 roubles a year, and provide themselves in clothing; all the rest of their expenses is paid by the government. They are to remain there as apprentices two years, and it is expected that at the end of six years a sufficient number of leading men will be dispersed over all the Russian empire. We have no doubt that some of our fellow journalists will record this with great praise, as an act of princely munificence. So it may be; but is it not better for a nation to help itself than to be helped by emperors and kings? On this subject the following remarks are so appropriate that we cannot help inserting them. After observing that Russia and the United States of America are at the opposite extremes of the two systems, in one of which the nation helps itself, and in the other can only be helped by its sovereign, the author quotes France and America as more happily illustrative of the effects of such a system than Russia, and says—

"Forty years ago the genius of Mr. Watt perfected the steam-engine, the most wonderful of those auxiliaries which science has furnished to aid the powers of man. The route across the Channel is short, and such an important improvement might have travelled to France in a very little time. But it so happened that while her men of science have explained its theory, and eulogized its usefulness, her manufacturers have been in no haste to avail themselves of its power; her artisans have remained ignorant of its construction; and the country which was conquering Europe had not the means of supplying itself with one of the most common instruments of industry till the secret was carried over by a colony of English workmen. America, we suspect, has not furnished a single memoir on the theory of the steam-engine, but she has done better. The art was not long practised in England when it was transported across the Atlantic to Philadelphia, and many years before the steam-engine was known in Paris, it was made in the highest perfection on the west side of Alleghany mountains, at Pittsburg, a town which did not exist when Mr. Watt made his discoveries.

"Nearly the same remarks will apply to steam navigation. England had certainly the honour of supplying the first hint of this great invention. America caught it up, improved upon it, and returned it to us a new and perfect art of boundless utility and power. What have our lively neighbours across the Channel been doing, while England and America have thus been reciprocating improvements? Why, the men of science who surround the French government have made steam navigation the subject of prize essays and ingenious speculations! Much has been written, and the powers of the Integral Calculus have been exhausted in illustrating high and low pressure, centres of percussion, and planes of resistance; but in the mean time the rivers and coasts of France were navigated by vessels built after the fashions of the fifteenth century, and were without a single steam-boat at a time when nearly three hundred were plying on the coasts and rivers of America!

"So far back as the reign of Louis the 14th, experiments were made, and the resources of science were applied to improve the form of ships. Nay, schools we believe were established in some of the seaports to teach the art of ship-building, and the best works on the subject are still in the French language. Undoubtedly the art has been improved in France by the pains which the government took to communicate scientific instruction to those who carried it on. Yet, see how the natural development of talent in a free society supplies the place of scientific refinements, and perfects art by a "royal road." The American vessels, built by men who are strangers to theory and Calculus, are confessedly the most complete in their construction and equipments of

any that cross the ocean, and what is more conclusive, they outsail those of every other nation, our own scarcely excepted.

"Men in power are apt to commit great mistakes in their estimate of what they can do for society, and what society can do for itself. They fancy that the active powers of man, like the expansive force of steam, can be turned into this or that channel at pleasure, or even be made to operate on one side with augmented energy by confining them on every other. They wish their subjects to be active, rich, and courageous, because this contributes to their own power and glory; but they wish them also to be slavish in their spirit, and ignorant as far as ignorance is compatible with their purposes. They have always the problem to solve—*jusqu' a quel point on doit tromper le peuple.* They would have the man they govern to crouch at the rod of each petty functionary, and yet to have the spirit of a lion in combating for their aggrandizement; to be acute and intelligent in some things, but to submit his reason to the priest and the magistrate without inquiry. They train him to base and servile habits, deal out to him a penurious pittance of knowledge, stupify his mind with prejudices, and when they have thus perfected the virtues of a good subject, they have extinguished the energy of the man."

SPECIFIC GRAVITIES. MECHANICS' INSTITUTION.

To the Editor of the Chemist.

Sir,—As you doubtless attended Mr. Cooper's Lecture at the Mechanics' Institute last Wednesday, you must have observed that, while treating on the specific gravity of the gases, he introduced the following table:—

The specific gravity of oxygen, compared to that of hydrogen, is as 16 to 1.

	Gr.
100 cubic inches of oxygen weigh	33.09
100 ditto of hydrogen	2.26
100 ditto of chlorine..............	76.00

Specific gravity of chlorine, 36.

I could not at the time reconcile the different parts of this table with each other; but being then too much engaged by the lecture to attend to it more particularly, I merely copied it, determining, when arrived at home, to inquire into its correctness. I accordingly turned to Mr. Brande's Lecture at the Royal Institution, reported in your 32d Number, and there found the specific gravity of oxygen stated at 15, and that of chlorine at 33.5. Concluding, therefore, that both could not be right, I resolved to examine into the true state of the case. For this purpose I proceeded, according to the rule laid down by Mr. Cooper, to divide the weight of oxygen and chlorine respectively by that of hydrogen. The following is the result:—

```
Hyd. Oxyg. Spec. Grav.
2.26)33.90(15
     226
     ----
     1130
     1130
     ----
     ...

2.26)76.00(33.6
     678
     ----
      820
      678
     ----
     1420
     1356
     ----
       64
```

Now, if my arithmetic be correct, the table should stand thus:

	Gr,
Hydrogen, 100 cubic inches weigh	2.26
Oxygen	33.09
Chlorine	76.00

$33.9 \div 2.26 = 15$ spec. gra. of oxygen.
$76 \div 2.26 = 33.6$ spec. gra. of chlorine.

Oxygen : hydrogen : : 15 : 1
Chlorine : hydrogen : : 33.6 : 1

From this it appears, that Mr. Brande is correct, the difference of 1-12th of a grain being too trifling to be worth notice. How Mr. Cooper, whose general correctness I admire, could possibly fall into such an error, as to tell us that 33.9 divided by 2.26 equalled

16, and that $78 \div 2.26 = 36$, I am at a loss to imagine; but can only suppose it must have happened through inadvertency. I trust you will favour this with a place in an early Number, as perhaps some who were present might have gone away under the impression, that the specific gravity of oxygen is 16, and that of chlorine 36; a conclusion which I have demonstrated above to be erroneous.*

I remain, Sir,
Your obedient servant,
Nov. 1. JAS. EDWARDS.

DICTIONARY OF CHEMISTRY.

COMBUSTION, in ordinary language, is synonymous with "rapid burning," and is so familiar an occurrence as to require neither explanation nor definition. In chemistry, however, it is a word of much theoretical importance, and the subject has perhaps occasioned more discussion, and given birth to more theories, than any other part of chemistry. The phenomena of burning have been so long familiar to us, that it seems to require no explanation. But to account for the production of the heat and light has long exercised the ingenuity of numerous philosophers. By some *both* have been called substances, and then the difficulty is to account for their condensation without increasing weight, and their liberation without diminishing the gravity of bodies. Others have supposed them only particular actions of other substances, or modifications of them, which, like the causes for our perceptions of touch, such as *smoothness* and *hardness*, may be rendered sensible without causing any decrease or increase of the body. A substance becomes neither heavier nor lighter, however much it may be handled or felt. But then the tangible properties of bodies are continually perceptible, while the sensations of heat and light are only occasionally excited. What, then, causes their momentary production? Whenever they are made perceptible, there is some change in the chemical constitution of bodies. According, therefore, to this theory, combustion is a chemical combination or decomposition, accompanied by the excitation in us of the sensations of light and heat. It is our business to endeavour to classify and arrange all the occasions or circumstances by which the excitation of these sensations are accompanied, just as we classify and record the circumstances which accompany any modification of our perceptions of touch. By one theory it has been supposed that combustion was always a union of oxygen with a combustible, the latter supplying the light, and the former the heat. In another it has been conjectured that there was a peculiar substance, called phlogistion, the combinations and separations of which occasioned all the phenomena. On the present occasion we cannot enter further into the subject, and have therefore only to observe, that the most prevalent opinion now is, that combustion is to be considered as merely an energetic chemical action of one body on another, attended by the excitation in us of the sensations of heat and light, just as some other chemical actions are attended with an alteration in the forms of bodies, some being changed from solids to fluids, and the contrary. It may, however, be added, that all ordinary cases of combustion are merely a chemical union of the combustible with the oxygen of the atmosphere and the emission of light and heat.

COMPOUNDS are distinguished into primary—those in which two or more simple substances are chemically united; and secondary—those in which two or more primary

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* We readily insert this communication, as correcting what we noticed at the time to be an error; but we concluded somewhat differently from our Correspondent, that it was so stated expressly by Mr. Cooper, that he might speak in round numbers; and that the inadvertence consisted in omitting to warn his hearers that it was so.—ED.

compounds are again chemically combined.

COMPTONITE. A mineral first brought to England by Lord Compton in 1818: it is found in Mount Vesuvius, and seems to have no very valuable properties.

CONCRETIONS, MORBID. Solid matters, formed by disease in different parts of the animal frame, have been so named. Those deposited in the soft parts consist mostly of calcareous phosphate, and are called *ossifications;* those deposited in the cavities are called calculi: of the latter, some are found in the gall bladder, and are called *gall stones;* others are found in the bladder, and are called *urinary calculi.* The former are found in various glands, and are called *pineal, salivary, pulmonary,* &c.

CONDUCTORS. Substances which transmit heat or electricity through them, or along their surfaces, have been called conductors. An iron rod, one end of which is placed in the fire, becomes heated through its whole length: a piece of wood so placed is burnt, and the outer end not heated. The former is a conductor, the latter a non-conductor of heat. A piece of iron placed in contact with an electrical apparatus carries off the electricity: a piece of glass stops it. The former is a conductor of electricity, the latter not. As the iron is in both cases called a conductor, it may not be unnecessary to warn the reader that the two effects of conducting are different. In the one case, the iron embodies the heat with itself; in the other, parts with the electricity as soon as it is acquired.

DIGITALINE.

THE active principle of Digitalis was obtained by digesting a pound of the plant of commerce in ether, first cold, and then heated under pressure; the solution was filtered and evaporated, the residuum dissolved in water and filtered, the solution treated with hydrated oxide of lead, the whole evaporated and digested in ether, which dissolved out the active principle. On evaporation it appeared as a brown pasty substance, slowly restoring the blue colour of reddened litmus paper, very bitter and very deliquescent. It is very difficult to obtain it crystallized, but a drop of its solution in alcohol, evaporated on glass, over a lamp, when examined by a microscope, gave abundance of minute crystals.

That conviction might be obtained of the active nature of this substance, a grain was dissolved in about 180 grains of water, and injected into the abdomen of a rabbit; in a few minutes respiration diminished, the circulation diminished, and the animal speedily died, without agitation or pain, which is the more remarkable, as the rabbit is convulsed with great facility. Half a grain in 120 grains of water, ejected into the veins of a cat, caused a similar death in about 15 minutes. One grain and a half in half an ounce of water, introduced into the jugular vein of a dog, caused death in five minutes. In all these cases the arterial blood presented a decidedly venomous tint, and coagulated with difficulty.—*Bib. Univ.* xxvi. 102.

SIR HUMPHRY DAVY'S COPPER.

MR. CHILDREN, the great advocate of Sir Humphry Davy, has published, in the Annals of Philosophy for November 1824, a reply to the statement which first appeared in The Chemist, No. XXXI. in a letter from a correspondent, and was afterwards copied into the newspapers, relative to Sir Humphry's plan of protecting copper having failed. We have since stated our own opinion on the subject, and now insert what Mr. Children says that has any bearing on this part of the question. As to his remarks about motives and insinuations, as we are conscious of none of the former but what are proper, and have insinuated nothing, we shall omit all this part of his paper, and leave the task of replying to his attacks to the newspapers against which they are directed.

"But to the *facts,*" says Mr.

Children, "and by their evidence let our readers judge of the *accuracy* and *justice* of the newspaper statements, and the bold assertion, that the experiments have failed.

"The two harbour boats which gave rise to the original exaggerated account, were *purposely over defended* by a surface of zinc in the proportion of about 1-25th of that of the copper, the object of those preliminary experiments being solely to ascertain the *efficacy of the plan as a preservative of the copper*, without reference to any ulterior effects. These boats were stationed in Portsmouth Harbour, and the copper remained bright for nearly three months, when it became coated with carbonate of lime, to the rough surface of which, the confervæ, always floating in the summer months in Portsmouth Harbour, adhered, and these soon caught other weeds; but they were all *loose*, and there were neither *barnacles, nor any other shell-fish, nor any worms*, amongst them; and it is more than probable, that the same weeds would have adhered even to carbonate of copper.

"Except in harbour, there is every reason to think that carbonate of lime could not adhere to the copper, even *with excess of protection*, and the confervæ must have been washed off in a ship at sea. Copper, until it is worn in *holes*, corrodes so fast that no permanent surface remains to which weeds can adhere; but when there are inequalities in the surface, they adhere readily enough even to the poisonous oxide of copper. I do not believe that any of the protectors placed upon *ships* are in such excess as to occasion any deposit, and if they are a little positive, or nearly in equilibrio, the whole surface remains smooth, and the adhesion of weed and shell-fish is prevented. As far as the experiments hitherto made enable one to judge, the requisite proportion of protecting surface to that of the copper is somewhere between 1-120th and 1-220th, but even 1-300th will save more than half the copper of the navy."

THE CAUSE OF THE MIGRATION OF BIRDS.

(*By Dr. Jenner. Continued from* p. 30, vol. ii.)

At the coming on of spring we observe our more domestic birds, those that approach our houses, and are most familiar to us, assuming new habits. The voice, gesticulation, and the attachment which the male begins to show to the female, plainly indicate some new agency acting upon the constitution.* This newly excited influence, which so conspicuously alters the habits of our birds at home, is, at the same time, exerting itself abroad upon those which are destined to resort hither. It is the preparation which nature is making for the production of an offspring by a new arrangement in the structure of the sexual organs, (viz.) the enlargment of the testes in the male, and the ovaria in the female.

No sooner is the impulse arising from this change sufficiently felt, than the birds are directed to seek a country where they can for a while be better accommodated with succours for their infant brood, than in that from which they depart.†

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* The rook, among many others, exhibits a familiar instance of the change of voice.

† Birds of the same species that are commonly stationary in this island throughout the year (I say commonly, for all, I believe, occasionally migrate) are migrators in other countries. The adult bird might, perhaps, find a subsistence for itself in the country it quits during the incubating season; but the nestling is probably the object nature chiefly holds in view, both with respect to food, and to the temperature of the air in which it is first to feel existence. The one may be unfit or too scanty, and the other too hot or too cold. It is wonderful to see with what peculiar care the parent birds select the food for their young until they are four or five days old. For the most part it is purely animal; but not an atom even of that is suffered to go into the nestling's stomach, that is not perfectly adapted to the tender state of its digestive powers. While the swift is feeding on small beetles that have hard crustaceous wings, and whose habitations are the air, its

It is not at the commencement of this enlargement, nor until it is considerably advanced, that the birds are prompted to migrate; and this is very wisely ordered; for were they to set off when first the testes and ovaria begin to grow tumid, they must waste much time here unnecessarily, and indeed arrive at too early a period to find a supply of food. Very little time is lost after their arrival, before they form their connubial alliances.* The business of nesting then begins; and as a convincing proof that nesting is the chief cause of their errand here, this and its natural consequences occupy their attention from the time of their coming to the day of their departure. This is illustrated by the dispatch which some of them make in performing the object of their mission. The cuckoo finishes this business in a shorter space of time than any other bird; but as he deviates so widely from the common laws of the feathered society, I shall select the swift as a better example for pointing out the fact. The swift shows himself here about the beginning of May (sometimes a few stragglers appear earlier,) and by the beginning of August he has completely reared his young ones, which seldom consist of more than two. At once the old birds and their family take their leave and are seen no more for that season. Now his further residence cannot be rendered unpleasant by any disagreeable change in the temperature of the air, or from a scarcity of his common food, which at this time abounds in the greatest plenty. This circumstance of the early departure of the swift, without a more apparent cause, seems to have excited much astonishment and perplexity in the mind of that attentive and ingenious naturalist, the late Mr. White of Selborne. Speaking of the swift (Letter XXI. page 184,) he says, "But in nothing are swifts more singular than in their early retreat. They retire, as to the main body of them, by the tenth of August, and sometimes a few days sooner; and every straggler invariably withdraws by the twentieth, while their congeners all of them stay till the beginning of October, many of them all through that month, and some occasionally to the beginning of November. This early retreat is mysterious and wonderful, since that time is often the sweetest season of the year. But, what is more extraordinary, they begin to retire still earlier in the most southerly parts of Andalusia, where they can be no ways influenced by any defect of heat, or, as one might suppose, defect of food. Are they regulated in their motions with us by a failure of food, or by a propensity to moulting, or by a disposition to rest after so rapid a life, or by what? This is one of those incidents in natural history that

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nestlings are fed in their early state with gnats. The sparrow, a granivorous bird, feeds its young for several days after they are hatched, with the softest insects only, now and then introducing a little coarse sand, smooth on the surface, to inure the stomach, as I suppose, to bear the same kind of substances in a more rugged state, which will shortly be required.

* Should a fatal accident befall either the male or female bird after this alliance is newly formed, no time is lost in unavailing sorrow, nor any great nicety shown in forming a new connexion, as the following little history will evince. A pair of magpies began to build their nest in a gentleman's garden at Burbage, in Wiltshire. Disliking their familiarity, he shot one of them from an ambush made for the purpose. The next day there were again a pair going on with the work. One of these was also shot. The loss was not long in repairing; for the day following the pair were again complete, when another fell a victim to the gun. Thus the gentleman went on destroying one of them daily until he had killed seven; but all to no purpose—the remaining magpie soon found another mate. The nest was finished, and young ones were produced, which were suffered to fly. This is an extraordinary fact.—It seems to show that nature has a reserve of birds in an unconnected state, immediately ready to repair losses. Were the whole to pair at once, the circumjacent country might be insufficient to furnish food for the immense number of young ones that must burst forth at the same time.

not only baffles our searches, but almost eludes our guesses!" Thus Mr. White.

Now, should the principle I have laid down be admitted, namely, that these birds come here for scarcely any other purpose than to produce an offspring, and retreat when the task is finished, how easily will all circumstances be reconciled! and how little mysterious will those things appear which naturally seemed unaccountable, not only to the amiable author from whom the foregoing passage is taken, but also to others who have written before on the same subject.

EFFECT OF HEAT AND COLD ON STONES.

M. Vicat *Ingenieur des Pont, et Chaussees* at *Souillac*, has lately observed that there was a considerable effect produced on the stones of a bridge recently built there, by the heat and cold. There was a sensible enlargement of the space between the stones in cold, and a sensible decrease in heat. In our country, where the variations of temperature, though numerous, are not so great as in many other countries, it may perhaps not be so necessary to take this effect into account. But for nice works in masonry, in countries subject to variations of temperature considerable in degree, it may be necessary to adopt something like compensation arches, as to obviate a much less effect, compensation pendulums have been used.

DECOMPOSITION OF SULPUROUS ACID.

M. Döbereiner has found that alcohol, saturated with sulphurous acid, dissolves more iodine than when it is pure. When the liquid containing these two substances was exposed to the solar rays, it deposited, to his great astonishment, crystals of sulphur.—*Bulletin des Sciences Technologiques.*

TO CORRESPONDENTS.

Oxalic Acid.—A Friend is informed, that we understand oxalic acid is seldom prepared expressly by the bleachers, because it is procured in the manufacture of several other substances, so that it is not economical to prepare it expressly. The following, however, are two modes of preparing it:—To 24lbs. of starch, divided among several tubulated retorts, and all placed in one common sand-bath, is added 72lbs. of common nitric acid. After a short time the starch begins to dissolve, decomposition takes place, and nitrous gas is evolved. When this action has ceased, 24lbs more nitric acid is added, and a slight degree of heat applied until all action has ceased. The liquid is then poured off into earthen pans to crystallize. About 5lbs. of oxalic acid is obtained. To the mother waters 24lbs. of nitric acid is afterwards added at different times, which gives about 2lbs. 8oz. more crystals. This is repeated a third and a fourth time, and the whole produce of oxalic acid is nearly equal to half the starch employed. Oxalic acid is crystallized by dissolving and recrystallizing it to separate the nitric acid. The other mode is this:—To any quantity of nitric acid add molasses gradually, till it equals by weight the sixth part of the acid employed. A gentle heat is to be applied to the mixture, and nitrous oxide escapes in abundance. When the molasses is entirely dissolved, distil off part of the acid till the whole has a thick syrupy consistence; and on cooling this will be found to crystallize, the crystals being oxalic acid, nearly equalling in weight half the quantity of molasses employed. The crystals must be dissolved and recrystallized. In some places oxalic acid is obtained from the *rumex acetosa* and the *oxalis acetosella*. A Friend must be guided in his speculations by the markets, his situation, and other circumstances, in all of which we can give him no advice.

We should suppose that if James Edwards makes a personal application to Mr. Jones, the Secretary of the Chemical Society, his difficulties will all be removed. We are not ourselves members, or we should be happy to give him any assistance in our power.

N. R.'s communication shall be inserted when the plate is prepared.

X. Y. shall be noticed in our next.

We are obliged to Philo Chemicus for his suggestion; we think his wish will be fulfilled by the illustrative experiments we purpose to give of the lectures which are in progress.

*** Communications (post paid) to be addressed to the Editor at the Publishers'.

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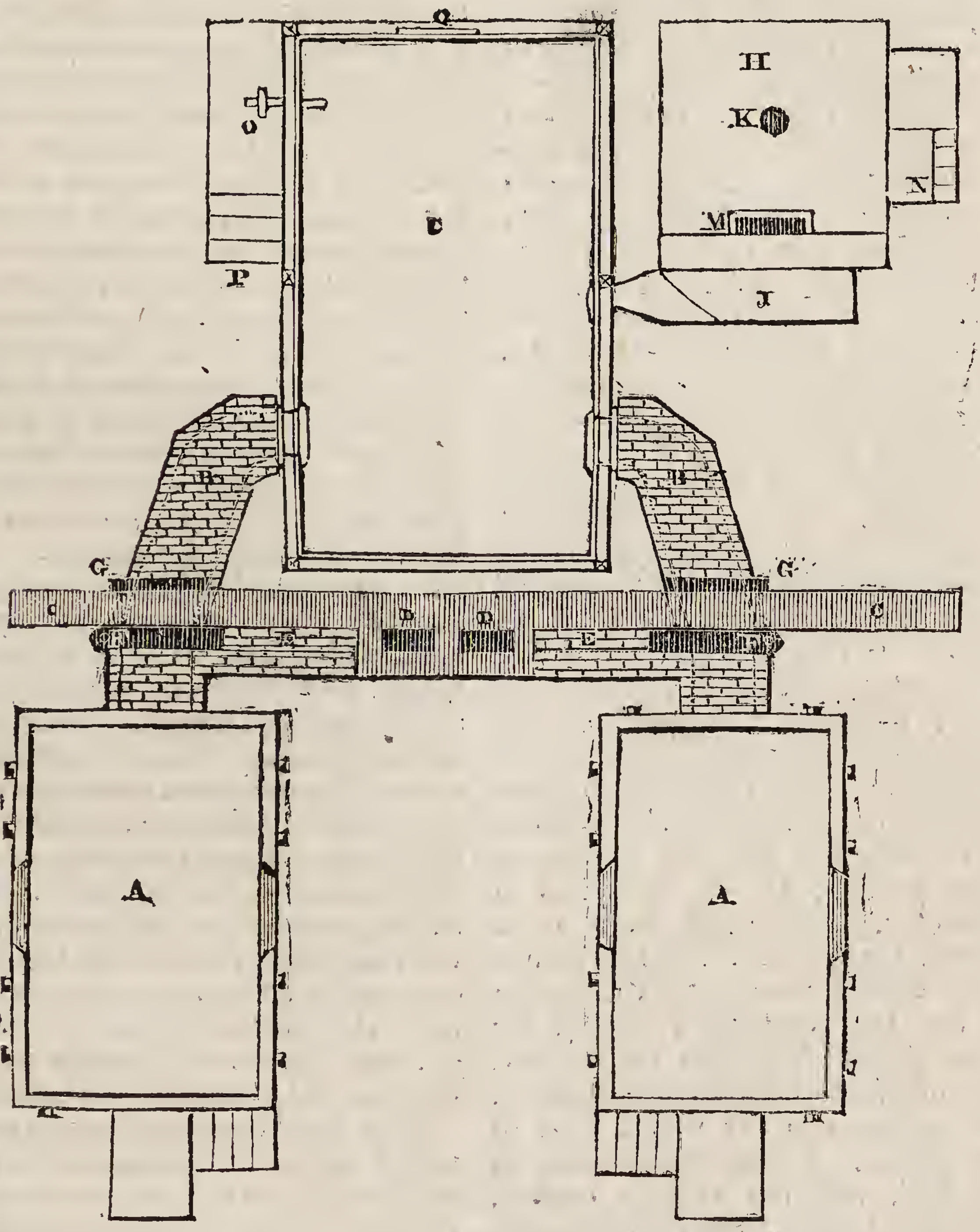

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MANUFACTURE OF SAL AMMONIAC.

(*Abridged from Parkes's Chemical Essays.*)

Sal ammoniac, or *muriate of ammonia,* is a neutral salt, and consists, when pure, of equal volumes of ammoniacal and muriatic acid gases condensed into a solid; or by weight, it consists of 68.52 acid, 2.125 alkali. It has been in common use for several centuries, and was formerly brought to this country, and to other parts of Europe, from Egypt. Nothing was for a long time known of the constituents of the salt, or of the mode of preparing it. At length, in 1700, Tournefort, the celebrated botanist, seems to have subjected it to analysis, and discovered of what it was composed. Geoffroy, a French chemist, also pointed out its constituents, in a paper read to the Royal Academy of Sciences at Paris, in the year 1716; and in the year 1719, the French consul at Grand Cairo, Lemere, sent to the same learned body an account of the mode of manufacturing it in Egypt. "The natives," says he, "collect the excrement of camels, oxen, and other animals, which feed on saline plants. This is dried and used as fuel, and from the soot muriate of ammonia is extracted. It is collected and put into large glass bottles, 18 or 19 inches in diameter, terminating in a neck several inches high. The bottles are filled within four fingers' breadth of the top, and then heated for three days. Towards the second day muriate of ammonia sublimes, and adheres to the upper part of the bottle. When the process is finished, and the vessels cooled, they are broken, and the ammoniacal salt taken out for sale. About one pound of the muriate is obtained from five pounds of the soot." After the discovery of its constituent parts, and after a knowledge had been obtained of the mode of manufacturing it, establishments for this purpose were soon set on foot in various parts of Europe. The first were in England and Scotland; afterwards they were established at Paris, and in various parts of Europe.

Before that time, muriatic acid had been long known, and used for a variety of purposes; but ammonia had only been obtained from the salt. After its properties were partly known, it was soon discovered that ammonia is disengaged from several animal substances in the process of putrefaction; and on pursuing this inquiry further, it was obtained in great abundance by subjecting the horns, bones, and hoofs of animals or fish to dry distillation. Having thus the two materials within their own power, it was only necessary for the people of Europe to procure and combine them at a cheap rate, to do away the necessity of sending all the way to Egypt for the prepared salt. The most obvious method of effecting the combination was a direct mixture of the acid and alkali; but owing to the waste of the gaseous alkali, this mode was soon found not to be economical. The plan was then fallen on of saturating the ammonia with sulphuric acid, which can be done with less waste, and then decomposing the sulphate thus formed, by adding a determinate quantity of muriate of soda. The ammonia combines with the muriatic acid, and the soda with the sulphuric acid, forming sal ammoniac and Glauber's salts. The saline mass is then evaporated, till the sulphate of soda will separate on cooling; the remainder is then boiled till the fluid is all evaporated, and by a continuation of the heat the sal ammonia sublimes.

This practice, too, was superseded by a more economical one, and at present carbonate of ammonia is decomposed by means of sulphate of lime. The aqueous product from the distillation of bones is digested on ground plaster of Paris, when, in consequence of a double decomposition, carbonate of lime precipitates, and sulphate of ammonia remains in solution. This is poured on a precise quantity of muriate of soda or common salt, when the muriate leaves the soda and the sulphuric acid leaves the

ammonia, and there is formed a muriate of ammonia and a sulphate of soda, the latter of which is separated by crystallization, and the former is sublimed. The plate represents the ground plan of the apparatus employed by M. Leblanc, at St. Denis, near Paris. His method consists of decomposing muriate of soda by sulphuric acid, in a kind of reverberatory furnace, the floor of which is covered with lead; and as the current of muriatic gas is determined into an adjoining leaden chamber, it is there, at the same instant, met by a current of volatile alkali, produced from animal matters, which are burnt in three iron cylinders placed in a furnace. The decomposition of the muriate of soda is not, however, entirely effected in the first furnace, but is removed into a second, capable of undergoing a greater heat. The alkaline residuum of the salt is employed to furnish crystallized soda.

A A are two furnaces for decomposing common salt, each 14 feet long by seven feet six inches wide. B B B B are pipes of bricks, each two feet wide, which go through the wall dividing the workshops, and conduct the vapours of muriatic acid gas into the chamber C. C is the leaden chamber where the muriatic acid gas and the ammoniacal gas meet for the production of muriate of ammonia, or sal ammoniac. D D are flues belonging to the two furnaces A A for carrying off the smoke of the fire-places. These are 14 inches by 24 inches each, and are carried up together, and at last united into one chimney above the top of the building. E E are pipes belonging to the two furnaces A, each 14 inches wide, connected with the chimneys, and designed for carrying off the muriatic acid gas by that conveyance into the atmosphere, when the furnaces are used for the production of soda without making sal ammoniac. F F are cast-iron plates or dampers, which open or shut the communication of the pipes E with the chimneys at pleasure. G G are similar iron dampers, which cut off or determine the passage of the muriatic acid gas into the leaden chamber C. H is a ground plan of the kiln for burning the animal matters designed to produce ammonia. J a leaden pipe to convey the ammoniacal gas into the chamber C. K is a hole through the arch or superior part of the kiln, which is designed to receive an eolipile, from whence the steam of hot water is forced into the chamber C, at the same moment when the acid and alkaline gases are entering the same receptacle. M the kiln chimney. N is a flight of steps leading to the ash-pan. O a pipe by which the chamber is emptied of the liquid muriate of ammonia when necessary. P a flight of steps leading under the chamber C. Q a door to enter into the said chamber. The peculiar advantage of this apparatus is, that while the muriatic acid gas is passing into the chamber C, at that moment another stream of ammoniacal gas is entering the same chamber from the kiln H, which occasions a mutual condensation and prevents any loss.

Sal ammonia is found native in the neighbourhood of several volcanoes, but not in sufficient quantities to supply the demand for it. The dyer employs it to moderate the action of nitric acid in the preparation of nitrate of tin, and also to modify the hue of some particular colours. It is used in the process of soldering, by the workers in copper and iron, to prevent the oxidisement of the metallic surfaces they intend to cover with tin. In pharmacy, several medicines are made by its means; and snuff-makers put it amongst their ground tobacco to make it more stimulant and pungent. The chemist uses it to produce artificial cold,—for analyzing metallic substances, for the extraction of pure liquid ammonia, and for the preparation of the ammoniacal salt with which smelling bottles are filled. It is said, that not less than 20 tons of this salt are used in Birmingham per year only in working with metals.

LECTURES ON CHEMISTRY AT THE ROYAL INSTITUTION.

ELECTRICITY.

Lecture 10. In the electricity produced by induction, Mr. Brande remarked, after recapitulating the subjects he had before treated of, there was a polarity produced, which showed a strong analogy between electricity and magnetism. If the substances so electrified were suspended like a needle, so that they could move freely, the similarly electrified ends would repel, and the oppositely electrified ends would attract each other like magnets. This was one similarity between the two, without mentioning other existing analogies. To make bodies electro-magnetic it is necessary, as had been shown, to put them into opposite states of electricity. Electricity, the professor went on to observe, exists in great quantities without manifesting itself. Thus the whole surface of the earth contains dispersed over it, a great quantity of electricity, and, unless when thunder storms occur, it is not perceptible, and no remarkable or electrical phenomena present themselves. If any change is induced in the electrical state by the contact of other bodies, the diffusion of the electrical fluid then becomes unequal, the electricity manifests itself, and the equilibrium is restored in a manner which is sometimes terrific. There is, then, a difference between the quantity of electricity which exists in bodies and the tendency to make its effects perceptible, and accordingly electricians speak both of the quantity and intensity of electricity, the former meaning the absolute quantity, the latter its tendency to escape. If a small and large globe be held to the prime conductor, the quantity of electricity communicated to each may be equal; it may be conveyed, indeed, from one to the other; but in the former its effects will be more manifest, being in the latter lost or dispersed over a large surface. The quantity, then, is the same, but the intensity is very different. When drawn to a particular spot, the intensity is great, and is judged of by the power of the electric fluid to pass through a stratum of air or other non-conductor. Of three Leyden jars of different sizes, and each charged by the same number of turns of the machine, it is found that the discharge can be made from the least of the three, with the discharger held at some distance from the jar; it requires to be held closer when the jar is larger, and must be brought into contact if the jar is of a very considerable size. When surfaces are extended, and the quantity remains the same, the intensity is diminished, there being a larger space in contact with the unelectric air; and it is found that wherever unelectric bodies are brought near electrified bodies, that the electricity is diminished. This fact is proved by the electromoter. When this is charged, or when the leaves are made to diverge, it is found, on approaching it with an uninsulated metallic plate, that the divergence lessens, and increases as the plate is removed.

When an insulated surface is opposed to another not insulated, so as to be electrified by induction, the electricity of the former is much increased by breaking the induction. This may be shown by using two brass plates, which are prevented from touching each other by two or three little knobs of sealing-wax dropped on one of them. The instrument is to be placed on the cap of the gold leaf electromoter, which it is to be prevented from touching by two or three small drops of wax, and the electromoter feebly charged, so as scarcely to make the gold leaves diverge. If the upper plate be connected with the ground by touching it, and then it be suddenly removed, by which the induction will be broken, it will be found that the electricity and divergence of the leaves will be much increased. This experiment was made, and, when the two plates were placed on one side of the electromoter, so that one of them

could be removed, it completely succeeded. It is on the principle of the intensity being increased by induction being broken, the professor continued, that doublers and condensers have been constructed, and by a series of these a slight quantity of electricity may be rendered conspicuous.

To get electrical power, it is necessary to combine quantity with intensity, and this was the reason for employing large jars, or a great many of them. When several jars are placed in a box lined with tin foil, that connects all their outsides, and their insides being connected by brass conductors, they then constitute what is called an electrical battery. When several such batteries were arranged together their power was very great, as there was a great quantity of electricity, which could be all made manifest at one time. The heat produced by a spark from a single Leyden jar, though the morning, from being so damp, was very unfavourable to electrical experiments, set tow on fire which had been dipped in resin, and inflamed gunpowder. In performing the last experiment it was necessary to transmit the electric shock through a tube of water, as part of the conductor, and when the experiment was performed without it the powder was scattered, not inflamed. Mr. Brande remarked that the effect of the water seemed to be to retard the electricity, so that the heat had time to act on the powder. By increasing the number and size of the batteries, a most intense heat can be produced, so as to melt and burn silver, gold, platinum, and other metals. Though the morning was much against peforming electrical experiments, the professor passed a shock through a piece of silver wire, on paper, and converted it into an oxide. He also passed a shock through a piece of gold leaf, disposed on paper, and the same effect was instantly produced.

There are several other modes of exciting electricity: thus when glass and a metal are brought into contact they become electric; but though the glass is positive when rubbed with silk, it is negative when rubbed with a metal. It has been often remarked, that the barometer tube, when shaken, becomes luminous, which is occasioned by the agitation of the mercury producing electricity. It is even enough to pass a current of air over or through a tube of glass, to excite electricity. Mr. Wilson showed that by blowing with a bellows against a plate of glass, electricity was excited. The kind of electricity in these cases always depends on the manner of exciting it; sometimes it being in one state, sometimes the other. Beccaria showed that the mere contact of two pieces of glass produced electricity, one becoming positive, the other negative. It seems, however, that the sort of electricity which is excited depends on some minute causes, which have not been ascertained. Two pieces of silk ribbon drawn across each other become electrified, the one drawn across the grain being negative, the one drawn with the grain being positive. A piece of white silk ribbon and a piece of black silk ribbon exhibit this phenomenon very distinctly. The change of state which bodies undergo very often causes electricity. Chocolate, when melted and cast into the tin moulds which give it shape, is found to be electric; so also sulphur, when melted and run into a mould, is found to be electric, and to preserve its electricity for a considerable time. This is an experiment very easily made, and only requires that the sulphur should be melted in a common glass By the evaporation of water, also, electricity is excited. This fact was proved in the following manner:—Over an electromoter was placed a small iron cup, heated nearly red hot, and a few drops of water let fall into it, which were of course immediately dissipated in vapour, and as immediately the gold leaves in the electromoter were thrown apart, indicating electricity. The steam, as it rises, also is electric, one electricity being

positive and the other negative. These facts serve to illustrate what goes forward in the atmosphere. The evaporation of water from the surface of the earth, and the falling of dew, both produce electricity; as the water rises into the atmosphere, it carries with it sufficient electricity to disturb the equilibrium; it condenses into clouds, and at length is again discharged with some of those violent phenomena which sometimes excite our dread, and sometimes endanger our safety.

The mere contact of two metals also occasions electricity. Mr. Bennet was the first person who discovered this fact: he having observed that when two metallic plates were put together, they became one negative and the other positive. Volta called the metals on this account electromoters. Different metals possess different powers, but in general it is observed that the most oxidable metals produce the greatest effects, while the least oxidable produce scarce any. A plate of gold and silver, when brought into contact, are hardly perceptibly electric, while a plate of zinc and silver produce a very great degree of electricity. So also the surface of mercury, when zinc is applied to it, becomes electrical. In general, the most easily oxidable metals of those brought into contact become positive, and the least oxidable negative. This source of electricity is most important, and perhaps it may be mentioned as another point in which there is an analogy between electricity and magnetism. It was first discovered by Mr. Bennet,* about 1787 or 1788, and Volta afterwards investigated the phenomena, in consequence of the discovery of Galvani, that the limbs of a frog were set in motion by being brought in contact with different metals. In the following list each metal becomes positive by the contact of any one before it, and negative by the contact of any one of those that follow it: — PLATINUM, GOLD, SILVER, MERCURY, COPPER, IRON, TIN, LEAD, ZINC; the greatest effect being produced by the contact of platinum and zinc. The others act on one another more feebly, and the action of platinum and gold is hardly perceptible. To produce any effect at all, it is necessary

* From this it would appear, that Mr. Bennet had as good a claim to the discovery of Voltaic or Galvanic electricity, as either of the foreigners whose name this interesting discovery usually bears. Galvani's discovery was as much the result of accident as Mr. Bennet's, and no more followed up. Volta, indeed, had the merit of pursuing the clue which had been offered him, and of inventing, in consequence, those instruments which bear his name. This fact is one of a thousand, which tend to show that all important discoveries are gradually arrived at, and are more the result of a general progress in knowledge, than of individual genius or talents. There is something in this important truth very worthy of attention and admiration. It shows, that the progress of our race in knowledge and power does not depend on the accidents of time and place, but is governed by moral laws, which are as regular in their operations and effects as the physical laws of matter. A discovery like the one mentioned in the text, and the existence of such individuals as Mr. Bennet and Volta, have, it is obvious, more influence over the permanent welfare of mankind than the existence of most men. But if it is also plain, that such discoveries are less the result of peculiar talents and genius than of the intellectual progress of the world, how much less must mankind at large be dependent for their happiness on individuals, whose names are connected with no improvements in art and no discoveries in science, and who are yet mighty in their day, from the reverence of other men, founded on the supposition that they are capable of promoting the general welfare? In the progress of our race there is much certainly to be proud of, and much to admire; but in the manner of honouring the individuals who slightly contribute to this progress, there seems a remnant of that superstition which, in the early ages of the world, clung to sensible objects, and worshipped the flood, and the flame, and the storm. Unable to picture to themselves that abstraction—the general intellect,—and anxious to have something positive to rest on, men are too prone to elevate individuals, and almost to worship them, as if they were that general and vivifying principle which animates the whole, and of which it is possible they may just have a trifling share more than their admirers,

that the metals should be clean, and in a metallic state. In the experiment of Galvani, by making a frog form part of the electric circuit, so that a piece of metal touched the crural nerve, the limbs of the animal, though dead, are thrown into strong convulsive motions. Mr. Brande made this experiment: the hind legs of a frog, recently killed and skinned, were laid on a piece of zinc, and a connexion established between the crural nerve and the zinc by a piece of silver wire, and instantly the limbs of the animal were convulsed. In making this experiment it is necessary that the animal should not have been a very long time killed, but cold-blooded animals exhibit the appearance longer than warm-blooded ones. The electricity excited by two pieces of metal, one of zinc and one of silver, placed above and below the tongue, was then mentioned, which Mr. Brande said sometimes produced, independent of the sensation in the mouth, an appearance of a flash of fire before the eyes. The preference which some people give to drinking porter out of pewter pots is probably to be referred to this metal producing a slight degree of electricity. Those who are curious in drinking-cups may have one made of zinc with a rim of silver, which will produce a very curious and strong sensation. Animals are sensible of a similar electricity. If a worm is made to crawl over a piece of silver, it betrays no uneasiness; but if it is made to pass from the silver on to a piece of zinc, it instantly starts back. Animals are therefore very delicate electromoters. Many of the chemical properties of the metals are also influenced by electricity. A thin plate of copper immersed in very dilute sulphuric acid has no visible effect; a thin plate of zinc, also, immersed in it separately, produces a very trifling effect; but if both be immersed, the effect is greatly increased, and bubbles rise rapidly to the surface. This arises from the decomposition of the water, the hydrogen going to the copper and rising through the water, the oxygen going to the zinc and continuing with it, forming an oxide. Here the professor stopped, announcing his intention to treat of the Voltaic Pile on the ensuing lecture day.

TEST FOR ACETATE OF MORPHIA.

A solution of acetate of Morphia which contains only 1-15,000th part, is sensibly troubled by adding a cold saturated infusion of gall nuts in alcohol, while ammonia will not render the presence of the acetate sensible, unless it contains 1-500th part. The spirituous infusion of nut galls is therefore thirty times more sensible than ammonia. In consequence however of the solubility of some combinations of tannin and animal matter in alcohol, this test for the acetate of Morphia, in cases of poisoning, cannot be exclusively relied on. It must be combined with other means.

ANSWER TO QUERY.

Mr. Editor,—Having seen in one of your late Numbers, that a Correspondent inquires after an easy method of producing a vacuum without an air-pump, allow me to recommend him to employ his own lungs; when, if they are strong and he is skilful, and the phial used is not very large, he may produce almost as perfect a vacuum as an air-pump. He may also try what he can do by means of heat. If he exposes the whole of a retort to the heat of a spirit-lamp, and while the air is expanded corks it up and cools it, he will have a partial vacuum; or he may insert a phial in boiling water, and cork it: in either case he will get a partial vacuum.

I am, Sir,

Your odedient servant,

Suction.

ON EXHAUSTION.

To the Editor of the Chemist.

SIR,—In your 34th Number, an inquiry is made as to the means of exhausting the air from small vessels, without the aid of an air-pump. I would recommend to your Correspondent the use of an exhausting syringe, a description of which I subjoin.

A B is a cylindrical brass tube, having at its lower extremity a valve C, opening upward. Into this cylinder the piston D is fitted exactly, and is moved up and down by the rod E. The part B of the tube below the valve is wormed for the admission of a screw-pipe, stop-cock, &c., by means of which the vessel may be attached. The piston is now drawn up, and forms a vacuum in the cylinder, to occupy which the air in the vessel immediately rushes up through the valve C. The piston D is provided with a valve inside, opening upward, access to which is obtained by two small holes, one above and the other beneath. When, therefore, the rod is forced down, the air in the tube shuts the valve C, and is thus prevented from returning to the vessel, and, entering the piston by the lower orifice, pushes up the valve, and is set at liberty by the opening above, marked F. On the piston being again raised, a second vacuum is formed, which is supplied in the same manner as the former; and on its being again forced down, the air escapes as before. In the same manner the stroke may be repeated till the exhaustion is complete. With a syringe of some capacity, as in the one represented above, this effect will be produced, in vessels of considerable size, in a very short space of time. It is scarcely necessary to add, that the correctness and celerity of this method is to be in a great measure secured by attention to the state of the valves and piston.

Nothing has tended more to the advancement of science, and of chemical knowledge in particular, than the encouragement which has been of late held out to free and familiar investigation of philosophical points, by the periodical press. If I have afforded your Correspondent, or readers in general, any information on the subject under discussion, it will, I am sure, yield me the highest pleasure.

I am, Sir,

Yours, respectfully,

Nov. 2. N. R.

FIRE UNDER WATER.

MR. SKIDMORE, of New York, has observed, that the luminous jet obtained by the oxyhydrogen blow-pipe may be introduced under water, without being extinguished. The only precaution necessary is to introduce it slowly, that the flame may not be repelled into the gas-holder. The flame viewed under water is globular. It burns wood, and heats metallic wires to redness. Mr. Skidmore thinks that this discovery may be advantageously employed in maritime warfare.

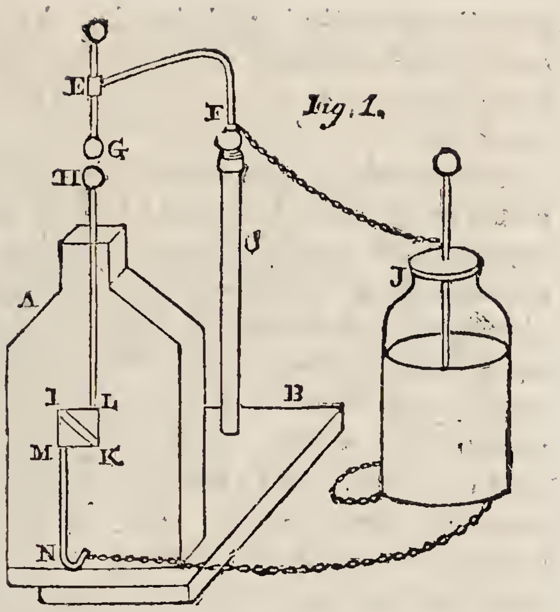

Fig. 1.

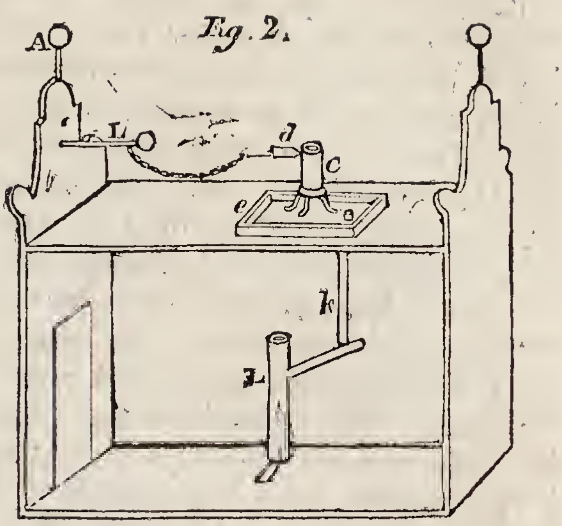

Fig. 2.

THE THUNDER HOUSE.

This is the name which was long ago given to a pretty little invention, to show the effects of lightning and conductors on buildings. It was first brought into notice during the contest which took place about the beginning of the American war, as to the propriety of having lightning conductors shaped at the end with points. The advocates of points ultimately carried the day, after a keen contest, in which very hard words were exchanged, and not a few acts of injustice committed; and there is now a reasonable share of doubt entertained, whether either knobs or points are of any great advantage. The little instrument, however, is curious, and we here subjoin a representation and description of it. A thick piece of board A, representing the end of a house, is fastened into the base B. About eight inches from A is fixed a glass pillar C, moveable about its axis, from the top of which proceeds a bent wire EF, having a spring socket F, through which a double knobbed wire FG is moveable. In the piece of wood A is fixed a wire HL, with a knob H at its extremity, and another wire MN bent upwards at N. Into a hole LMK, about a quarter of an inch deep, and nearly one inch wide, is loosely fitted a square piece of wood, of the same shape, which can be taken out at pleasure. A diagonal wire IK is fastened to the piece of wood. Let a charged jar J be now placed near the apparatus, so that its inside coating communicates with the ball E by means of a chain, and its outside coating with the wire N by means of another chain. Having placed the balls G H at a considerable distance, take out the piece of wood ILKM, and put it in so that the wire IK lies in the direction ML, and forms a communication with the wires HL and MI; then bring the balls GH gradually nearer one another, and at a certain distance the jar will explode, and no particular effect will be produced: the explosion being carried off by the continuity of the conducting wires. Let the wire IK be now placed as in the Figure, so that there is an interruption in the conducting wire HLMN, and let the jar be exploded as before. The piece of wood ILMK will now be thrown out of its place to a considerable distance, as the electricity does not find a ready passage from L to M. In this experiment, the explosion of the jar may represent a thunder cloud above the chimney of the house A, which is saved when protected by a continuous conductor, but thrown down when the lightning does not find a ready passage.

THE POWDER MAGAZINE.

This is another little invention, on the same principles, answering a somewhat different purpose. The brass ball A communicates with L by a brass wire; L communicates with the ivory piece *d* by a brass

chain; and the ivory piece *d* communicates with the brass tube *c*, standing in the brass dish *e*. This again communicates with the brass pipe *k*, which is connected with the hollow arm L. The tube *c*, and the ivory piece *d*, are then filled with loose gunpowder, and the brass pin is stuck into it within a quarter of an inch of the bottom. Alcohol is poured into the dish *e*; wettish gunpowder is put into *k*, and L is filled with gunpowder hard pressed. The house being then shut up, and its roof placed upon it, the outside of a Leyden phial is made to communicate with a hook below L; and as soon as the communication is complete, by making the inside of the jar communicate with the ball A, the explosion of the gunpowder in *c* and *d* will blow off the roof, and, inflaming the alcohol, will set that part of the house on fire, and, after burning some time, it will kindle the gunpowder in the tube *k*, and when it is consumed, the powder in the arm L will be set on fire, and, after a loud explosion, the house will be blown up, and fall to pieces.

CHEMISTRY OF DIGESTION.

That very curious conversion of food and drink into substances proper to repair the continual waste of the body, and into the excrementitious matter which is continually thrown off from it, is partly a chemical and partly a peculiar animal operation. The chemical part of it consists in the decomposition of the food by the action of certain juices, its conversion first into *chyme*, then into *chyle*, and afterwards into blood and into excrementitious matters; and the animal part consists principally in the secretion of certain peculiar fluids, which, by their mixture with the food, produce these chemical changes. If those who indulge too largely in the pleasures of the table were sometimes to contemplate the very curious process they are so liable to interrupt, they might perhaps pause in their excesses, and have some dread of injuring a system, all the parts of which have not yet been fully explained. As far as it is at present known, we shall here lay an outline of it before our readers.

The food of animals, and particularly of man, consists, as is well known, of almost every species of animal and vegetable substance. In Europe, the food of man consists principally of the flesh of animals, the seeds of certain grasses, and a variety of fruits and vegetables. His drink is water, milk, spirituous liquors, beer, wine, and an infusion of leaves and berries. In New Holland we find the savages feeding on worms; the Esquimaux eat a sort of moss or lichen, called rock tripe, and drink whale blubber; and the Siberians and Kamskatdales swallow masses of meat, amounting, according to Captain Cochrane's account, to thirty or forty pounds in a day, which they rinse down, whenever they can get it, with draughts of melted butter. In Norway, bread is frequently made out of the inner rind of the bark of the pine-tree, ground up with fish bones; while in Switzerland, it is not unusual, in scarce seasons, to place lumps of hard cheese on the table, which supply the place of bread. Humboldt tells us of a race of Indians on the borders of the Orinoco, who eat a sort of fat, greasy earth; but it is supposed they take this into the stomach rather to still the cravings of emptiness than to obtain from it a supply of nourishment. In China there is a species of bird's-nest which is considered to be a great luxury; and snails, frogs, and reptiles, that one shudders only to read of, form part of the food of many of the nations of the globe. Such is the extraordinary power of the solvent juices secreted in the stomach, that all these various substances are dissolved, and changed into fluids that always resemble one another, and seem possessed of precisely the same properties.

There are many substances which do not afford nourishment, and others, as is well known, which destroy the body sooner or later.

These are called poisons. We do not mean at present to take any notice of their action, but merely mention them to remind the reader that great as is the chemical power of the secreted juices of the stomach, it is not unlimited. What is perhaps remarkable in this case, is its peculiar properties in different animals; in some, as in the gramnivorous animals, it is a better solvent of vegetable than of animal substances; in others it dissolves only animal matters; while it seems possible, as we shall hereafter have occasion more particularly to point out, by gradually changing the food of animals, to alter the properties of the secreted juice; so that sheep, which naturally live on vegetables, have been brought to digest and subsist on animal substances. The principles of digestion are the same nearly in all animals; but the mechanism of the process is somewhat different in the different tribes, so as to have, if we take two extremes of the scale, such as man and an oyster, hardly any thing in common. Our present business is not to describe the digestive organs of different classes of animals, which is, however, a very curious study, but only to explain the chemistry of the process in the more perfect animals, principally in man, and in the carnivorous tribes, in which it is very much the same.

The food taken into the mouth is reduced in almost all animals to a kind of pulp by the action of the teeth, and by being mixed with saliva. This particular secretion, known under the common name of spittle, is produced by several glands, situated on each side of the mouth, lining it, as it were. The principal salivary glands are the *parotid*, situated near the ear: the *sub-maxillary*, on the inside of the lower jaw; and the *sub-lingual*, under the anterior portion of the tongue: all these are yellowish coloured bodies, irregular on their surface, and pouring out a large quantity of saliva whenever food is even present or thought of, or whenever it is taken into the mouth. Its production in the process of mastication is much increased by the mechanical action of the lower jaw; and the effect of thinking of food in producing it is evident from the slavering of dogs whenever they expect to be fed. This fluid has been closely examined, and is chemically described as limpid, like water, but more viscid, having neither smell nor taste: it is usually mixed with air, and froths on being agitated. It readily absorbs oxygen, and gives it out to other bodies. Hence the reason why gold and silver are oxidized by being pounded in a mortar with saliva, and why mercury is killed by spitting into the mixture of it and oil: hence, also, probably, the healing efficacy of licking wounds, which not only keeps them clean, but imparts oxygen, stimulating them to a healthy action. The constituents of saliva are, according to Berzelius—

Water	992.9
Peculiar animal matter .	2.9
Mucus	1.4
Alkaline muriates .	1.7
Lactate of soda and animal matter	0.9
Pure soda . . .	0.2
	1000.0

The mucus has the appearance of coagulated albumen. Such are the chemical properties of the first animal secretion with which the food is mixed, and which serves the additional purpose of lubricating the throat, and thus promoting the passage of the food into the stomach.

After the food has been ground by the teeth, and mixed with the saliva, it passes into the stomach, where it immediately begins to undergo another change, and in the course of a few hours is converted into an apparently homogeneous pulpy mass, called *chyme*, and which has nearly lost all resemblance to the original food. The stomach itself, in which this change is effected, is a strong soft bag, of different forms in different animals. In man it is long, round, and tapering, and has been compared to

the shape of a bagpipe-bag, and to a cone with the base drawn back towards the summit. It is placed obliquely across the upper and back part of the abdomen, and has a considerable power of extension and contraction, its permanent size depending in a great measure on the quantity of food usually thrown into it; and it is generally, therefore, much larger in men than in women. Anatomists describe it as consisting of four coats, the outer one of which—the *peritoneal*—seems to serve principally as a protection, and is not itself very susceptible either of pain or inflammation. The second is the muscular coat, consisting of two planes, or series of muscular fibres, intersecting each other, one set shortening and the other narrowing the stomach by their action, and thus serving to give it a gentle motion, which has been compared to trituration. The third coat is a fine cellular substance, without fat, and is supposed to strengthen the stomach. The fourth coat, called the *villous*, has a velvety appearance, and consists of fine short prominent *villi*, crowded with small vessels, some furnishing a mucous liquor, others absorbing a portion of the thinner part of the food. From the inner surface of the stomach there issues a liquor approaching the nature of saliva, and called *gastric* juice. It is supposed to be secreted by the arteries of the stomach and by the villi, for there are no distinct glands in this organ, as there are in various other parts of the body, destined to promote particular secretions. There are, then, two operations performed on the food in the stomach; it is triturated by the action of the muscular coat of the organ, and by the action of surrounding muscles, and it is mixed with the gastric juice. It was originally supposed, that the conversion of food into *chyme* was entirely owing to the trituration: but Spallanzani, Stevens, and others, inclosed food in hollow metallic tubes and balls, full of holes, so that the mechanical action of the stomach could not affect it, and yet, after a season, it was converted into chyme, just as if it had not been so protected. The change was afterwards ascribed to fermentation; but it was found, that substances which are converted in the stomach into chyme in a few hours, remain unaltered for weeks in the same temperature out of the body. It was observed, too, long ago, that when voracious animals had taken in too large pieces of food, or seized on prey which did not wholly enter the stomach, that only that part which did was converted into chyme, while the part remaining in the œsophagus continued entire. If it were merely fermentation, also, the process should go on, provided the temperature be the same, equally well in health as in disease: but this is not the case; and when, in consequence of disease in the stomach, its functions are not perfect, the food runs into fermentation, producing flatulence and eructations, &c. &c. The opinion, therefore, that the conversion of the food into chyme was occasioned by fermentation, is now given up; and this change is said to be effected by the chemical properties of the *gastric juice*. Its nature, however, will be more particularly described in a subsequent Paper.

(*To be continued.*)

ADULTERATIONS OF BREAD.

Mr. Editor,—I was once travelling in Italy, and near Rome had it in my power to do an Italian gentleman, long resident in that city, a trifling piece of service. The consequence of this was, that we became rather intimate, and lived and travelled together for a day or two, when he intending to stop at Viterbo, while I was going on to Rome, we separated. At parting, as the last memorial of his kindness, after he had kissed me on both cheeks, and I had kissed him in return,—for having early resolved in my peregrinations "to do as they do at Rome," I had long been in the habit of offering and receiving the friendly salute of the country after the fashion of

its inhabitants,--he gave me the following advice: —"You are going," said he, "to the eternal city; I have been long there, and know its inhabitants well; let me advise you to form no friendships there, either with man or woman; make use of them; make them both subservient to your pleasure, but never think of them afterwards. Form no connexions with females; on visiting them you will find them all smiles and kindness, and if you never visit one twice you will have perpetual smiles. You may live in the sunshine of beauty, but be assured these smiles are only put on to win you, and when once they have seduced you into a feeling of attachment, no art, no treachery will be spared to lighten your purse, and no care taken to prevent your health from being injured, or to save you from dishonour and destruction. Never go twice to the same tradesman. To obtain your custom they will promise largely, and do your first job, if it be a small one, well, and at a reasonable price. This is meant to entrap you. You may be cheated on employing them a first time—you will be sure to be defrauded if you ever repeat your orders. Never dine twice at the same inn or eating-house, and you will fare better than any man in Rome. The cooks, who are cunning rogues, always treat every new comer like a prince, and are reasonable in their charges. Above all," he concluded, "never place any confidence or faith in the words of an ecclesiastic. If he pretends to be religious he is a hypocrite, looking for wordly advancement: if, as you will find many at Rome, he assumes the character of a libertine, he means to make an attack on your purse if not your life, and if he cannot succeed in plundering you will accuse you of some heinous offence." I thanked my acquaintance for his advice, and, according to general custom, resolved not to profit by it. I afterwards found, however, that the suspicion he recommended would have been of essential service to me. Had I followed his advice, I should not have had my pocket picked by a woman, been overreached by a tailor, disgusted by the filth and exorbitant charges of the person with whom I contracted for my board, nor have been led into a long course of gambling and licentiousness by an Abbé of distinction. This part of my life has been lately recalled to my recollection by seeing a little pamphlet called The Tricks of Bakers unmasked,* the object of which seems to be to infuse into the minds of the community a degree of suspicion like that recommended by my Italian friend.

The certainty of being imposed on is perhaps not so great an evil as that of living in a constant state of suspicion. I hold no man, therefore, to be a friend to his kind who endeavours to excite general distrust. A reasonable share of discretion ought unquestionably to be exercised; but, even after my experience at Rome, it is better to be confiding though cheated, than distrustful and suspicious though undefrauded. But is the state of society in England the same as in Italy? Is it necessary to believe every tradesman a scoundrel, and every man only anxious to obtain a little wealth by dishonesty? This is what we must believe, at least as far as bakers are concerned, if Mr. Maton's book be correct. One instance, and one only, I believe, he does state, of a baker who did not, by the assistance of his journeyman, James Maton, defraud his customers. Every other page of his letter is full of base, low, and vulgar tricks. This only proves, Sir, that the said James has always lived with bad masters; but not that the trade are all scoundrels. I should not have troubled myself to take any notice of Mr. Maton's book, as that will only serve to give currency to suspicions it is for the interest of all not to have excited; but

* A Letter addressed to the Right Hon. the Lord Mayor of London, by James Maton.

whether the evil exists or not to the extent he mentions, publicity seems its best remedy. It is the dark and unexpressed suspicion which is most injurious. I took up Maton's book, supposing I might find in it some examples of the manner in which bakers adulterate bread, that I might have communicated them to the readers of The Chemist, and perhaps have suggested a means of detecting them. Mr. Maton gives no such examples, however, except one or two, and chiefly of army contractors, working potatoes up with flour, and using salt water instead of salt; so that the fair inference is, that adulterations of bread take place much less frequently than is generally supposed, and as generally asserted. Mr. Maton's book is a vulgar *exposé* of cutting off meat, stealing fat, and making over-charges, — things which can escape the notice of no commonly discreet housewife, and which no prudent, not to say honest, man would do, because he would be certain of being detected. As I have been quite disappointed, Mr. Editor, in Mr. Maton's book, let me request you to insert this notice; and inform your readers either that Mr. Maton is ignorant of any chemical frauds practised on the bread, or he does not choose to expose them. The suspicion he labours to excite of all master bakers must necessarily be unjust to many, and is nothing more than a fresh repetition of the old story, apparently the combined invention of those who wish to govern by fraud and those who wish to govern by force, that all men are rogues, which no individual can believe without including himself in the category. That soldiers may receive bad bread is very likely; but it can scarcely excite much sympathy in the rest of mankind that those whose trade is bloodshed should be ill treated, either by the carelessness or fraud of their employers. Mr. Maton, I repeat, makes out no good case against the master bakers who furnish the great mass of the community with their bread, and labours, I hope in vain, to excite suspicions that are certainly unwarrantable even by his assertions.

The following description of a contract and contractor will show how prisoners were treated; but even they, we believe, were, towards the latter end of the war, paid more attention to.

"I got employ," says Mr. Maton, "at Portchester, to bake bread for the French prisoners, under the agency of the celebrated Dr. ——, who had undertaken to supply all the prisoners of war according to the terms of the following contract, viz:—

"'I undertake for twelve months to supply all the prisoners of war that are in, or may be in Great Britain, Ireland, Scotland, and Wales, together with the islands of Jersey, Guernsey, Sark, and Alderney, with such quantity of well-baked bread as may be requisite from time to time, and in like manner to supply them with good ox beef, fish, vegetables, &c.; and in case of death, to provide coffins, shrouds, and burial grounds.'

"Thus the sage Doctor ——, by a Treasury stroke, at once became baker, butcher, parson, doctor, clerk, cook, fishmonger, gardener, undertaker, grave-digger, sexton, &c. And the said Doctor —— entered into a bond for the due performance of his contract.

"My new employer, supposing me to be a raw countryman, judged I knew nothing; but this I know, that I assisted in the baking of bread for the prisoners which no one could eat. It was certainly not made for Englishmen, but only for the poor prisoners of war, which government paid for being properly subsisted. The mixture of these unfortunate captives' bread consisted of wheat, barley, rye, oats, beans, peas, and caravanseras,* to which were added leaven instead

* Caravanseras, an American legume, says Mr. Maton; we believe they are the French *haricots*, or the well ripened seed of the French bean, which are much used in France as a vegetable.—Ed.

of yeast, and sea water was used as a substitute for salt; our bakehouse was contiguous to the sea, an arm of which washed its walls, and here first I became acquainted with the use of salt water in the making of bread. The bakehouse contained six ovens, each of which at a batch baked seven hundred and twenty pounds of bread, and four of these batches were drawn in twenty-four hours. The daily consumption of flour and its appendages were forty-eight sacks, that is to say, a mixture of wheat, barley, rye, oats, beans, peas, &c. Now it requires four pounds of salt to work a sack of flour into bread, and as Doctor —— used salt water, the gift of the elements, in lieu of salt, he pocketed the value of one hundred and ninety-two pounds of salt, or ninety-five thousand eight hundred and eighty-eight pounds sterling during the period of the thirteen lunar months of his contract! What a defraud upon the revenue! What wickedness towards the poor prisoners, which government required to be duly nourished, and for which a remunerating price was most punctually paid. The fact was, that we were unable to eat a morsel of the bread ourselves."

In giving these remarks a place, Mr. Editor, in your miscellany, you will oblige

A Confiding Man.

DICTIONARY OF CHEMISTRY.

Conglomerite, *breccia*. A compound mineral mass, containing imbedded fragments of stones.

Conite. An ash-coloured mineral, composed of 67.5 carbonate of magnesia, 28 carbonate of lime, 3.5 oxide of iron, and 1 water. The same name has been given by Dr. Macullock to a pulverulent mineral, which is fusible as glass, and runs into a transparent bead, which he found in the Hebrides.

Constituents. The separate chemical parts of any substance. The term differs from *elements*, inasmuch as this is restricted to the simple undecompounded substances which are detected in any body, while constituents comprises those compound substances which we obtain on decomposing it.

Contagion. That particular circumstance which disposes the human body, at different times and places, to particular and generally prevalent diseases, and which is supposed to arise from some peculiar aerial matters in the atmosphere. We have no tests sufficiently fine to detect them; but Guyton Morveau has rendered it probable they are compound bodies. Strongly concentrated acetic acid, nitric acid, muriatic acid, and chlorine, are all capable of decomposing them, and purifying the air, more particularly the latter, which is now generally used in hospitals and prisons.

Copaiva. A balsam obtained from the *copaifera officinalis*, a South American tree from the trunk of which it exudes.

Copal, *gum copal*. A hard, shining, transparent, citron-coloured, odoriferous substance, which is the juice of an American tree become concrete. It is improperly named gum, as it is not soluble in water, like gum; nor is it, like resins, soluble in alcohol. It may be dissolved by being digested in linseed oil, rendered drying by quick lime, employing a heat not quite sufficient to decompose the oil. This solution, diluted with oil of turpentine, forms a beautiful transparent varnish, which is very hard and durable. It must be slowly dried. It is applied to snuff-boxes, tea-trays, and other articles.

Copper. This well-known metal is, in the chemists' estimation, a simple undecompounded substance; its properties have already been described in The Chemist.

——, Acetate of, *verdigris*, is obtained by exposing plates of copper to the action of vinegar.

——, Carbonate of, *malachite*, *blue copper ore*, *anhydrous carbonate*. A compound of carbonic acid and the oxide of copper, which is both made by art and found native: it is of an apple green colour.

——, Muriate of, *green sand of Peru*. A compound of muriatic

acid and oxide of copper, found in the state of a pure green powder, mixed with grains of quartz.

COPPER, NATIVE. Copper is found in its metallic state in many mines, and then is called native.

———— NICKEL, *arseniuretted nickel.* An ore of nickel.

————, PROTOCHLORIDE OF. The *rosin of copper* of Boyle.

————, OXIDES OF. There are two: the protoxide consists of copper 100 parts, oxygen 12.5; the peroxide consists of copper 100, oxygen 25.

————, SILICATE OF, *emerald copper ore, dioptase.*

————, SULPHATE OF, *blue vitriol, blue copperas, persulphate of copper.* A compound of sulphuric acid and the peroxide of copper.

————, TARTRATE OF, with potash, *Brunswick green.*

————, WHITE. A peculiar ore of copper, very rarely met with. The white copper of the Chinese is an alloy of copper and nickel.

COPPERAS (common), *green vitriol, sulphate of iron,* is obtained by moistening pyrites, and exposing them to the air.

———— BLUE, *blue vitriol.* A persulphate of copper.

MECHANICS' INSTITUTION.

MR. COOPER'S OMISSION.

AT the close of his lecture on Wednesday evening, Mr. Cooper informed the Mechanics that the true scientific weight of hydrogen gas, as determined by M. Gay Lussac, was not, as he stated in his former lecture, 2.26, but 2.11, and by dividing the weight of 100 cubic inches of oxygen and of chlorine by this latter sum, it was found that the specific gravity of the former was 16, and of the latter 36. After making this explanation, and acknowledging that he had omitted it on the former evening, he expressed something like displeasure and regret,—we did not catch his exact words,—that any notice should be taken of his lectures in the periodical publications of the day. He further stated, as we understood, that the person who had pointed out the discrepancy in his statements had been very premature in doing so; and though, having undertaken to give a certain number of lectures to the mechanics, he meant to fulfil his promise, he should do it with much less pleasure if attacks were made on him which were injurious to his reputation as a chemist.

We do not agree with Mr. Cooper, that the communication of our Correspondent was premature, for it brought forth that explanation which has relieved him, and probably many others, from the embarrassment of two statements which contradicted each other. If he had made personal application he would have been individually informed of the source of the error, but by proceeding as he did, he got the error rectified for the whole Society. Mr. Cooper certainly will not say that error is beneficial; and he will therefore admit, the sooner it is corrected the better. He should have been thankful for being reminded of his omission, not angry that he is not infallible.

BRILLIANT LIGHT.

THERE is no light which man has yet produced that is so brilliant as the light of burning phosphorus in oxygen gas, with the single exception of the light produced by the annihilation of the opposite electricities of a powerful Voltaic battery. To produce this powerful and intense light, it is only necessary to immerse a piece of kindled phosphorus in a jar containing oxygen gas; when, if the room be dark, the light is so powerful as to dazzle the beholders.

TO CORRESPONDENTS.

We should suppose that the Epsom salts of X. Y. are as good as ever, though not quite so powerful, the salt having merely effloresced.

"A Limb of the Law" should, perhaps, apply to the fire-work maker; we will, however, do what we can to oblige him.

*** Communications (post paid) to be addressed to the Editor at the Publishers'.

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The Chemist.

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Fig 1

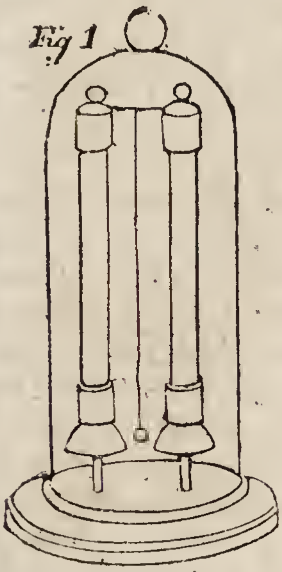
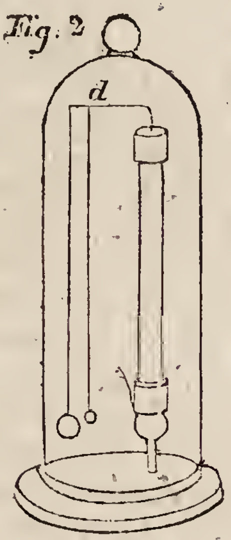
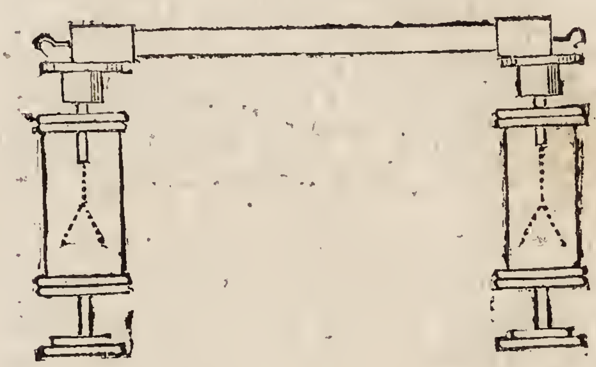


Fig. 2





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ELECTRIC COLUMN. PERPETUAL MOTION.

In our account of Mr. Brande's lecture, we have mentioned the electric column invented by De Luc, and our last plate represents such a column, consisting of 1000 series, lying horizontally on two delicate gold leaf electrometers; and it will be observed in the plate, that the electrometers both indicate the presence of electricity. In the column, therefore, as in the Voltaic battery, the electricity is constantly renewed. This has been put to a variety of amusing purposes. The figure No. 1, represents two such columns, placed vertically in a glass receiver, having a bell fixed at the lower extremity of each, and having a brass ball suspended between them, by a very fine thread of raw silk. Mr. Singer, who constructed this apparatus, found that the production of the electricity was so continual, that the bells never ceased to ring for 14 months, except during its removal from place to place. For six months it was never disturbed, and there was then no interruption whatever to the ringing. In Mr. Singer's opinion, the action of a well constructed column will be permanent; he had some that after being three years constructed were still as active as

ever. To keep it in good order, however, the two ends should not be connected by a conducting substance for any length of time; and it is therefore necessary, when a column be laid by, that it be placed on two sticks of sealing-wax, so as to keep its brass caps about half an inch from the table. A column, which appears to have lost its action from lying by, will generally recover its powers when insulated in this way. Too much moisture also destroys it. An increase of temperature increases its power. In winter, Mr. Singer's bells always ring slower than in summer; and when a fire is made in the apartment, their action always increases.

The aërial electroscope is an instrument for determining the electric state of the atmosphere, and this is another use to which De Luc applied his column. It is placed vertically within a glass receiver, and consists of from one to two thousand series. A bent wire, having a ball *a* at its lower extremity, is connected with the upper extremity of the column, so as to hang parallel to, and at some distance from it; opposite to *a* is a similar ball, *b*, screwed into the lower cap of the column; *f* is a brass fork, to prevent the little ball *a* from striking against the column, which it will otherwise do. The pendulum *d c*, is a fine silver wire, suspending a gilt pith ball.*

* We regret to observe that our engraver has omitted the letters of reference.

CHEMISTRY OF DIGESTION.

(*Continued from* p. 124.)

THAT particular faculty which is possessed by the stomachs of animals, of dilating and contracting as it were at pleasure, is singularly well adapted to the circumstances in which they are placed. We have already mentioned the enormous quantity of food which is sometimes swallowed, according to Captain Cochrane's account, by the natives of Siberia; and all travellers, more particularly those illustrious voyagers who have lately visited the Esquimaux, describe savages as sometimes eating at one meal as much as a civilized man consumes in a week, and sometimes fasting, apparently without inconvenience, for several days together. They could not do this unless their stomach were that flexible bag we have described it to be. It is obvious that all those animals which live by hunting, must sometimes have a glut of food and sometimes a difficulty in procuring any. This particular capacity of the stomach may be considered as having been necessary in the infancy of society to preserve the race of man. We, indeed, who regularly eat, at the very least, twice every day, find no necessity for such an adaptation; nor would our stomachs, so altered are they by our practices, lend themselves, without difficulty and risk, to any such alternations of gluttony and starvation. But if this peculiarity of the stomach be worthy of remark, the peculiar properties of the juice which it secretes, and its apparent faculty either to secrete that or not, as circumstances require, is still more remarkable. The gastric juice has such energetic *solvent* powers, that hardly any animal or vegetable substance can resist its action. Some few things, indeed, such as the husk of grain, the seeds of apples, the stones of fruit, &c., are not touched by it, as if nature were willing, by thus protecting seeds, to ensure the continuance of every species of grass and fruit, and perhaps provide for their more extensive distribution. But though these thin membranes, for it is only the husks which the gastric juice does not attack, be insoluble in it, portions of the hardest metals have been corroded by it in the stomach, and bones and horns only resist its action for a short time. But the stomach itself is an animal substance, equally liable to be destroyed by this secretion, as far as chemical affinities are concerned, with the other animal matters taken as food. In fact, also, the celebrated Mr. Hunter, the surgeon, ascertained that this very gastric juice, which has no action during

life, often dissolves the stomach after death. He found, on more than one occasion, the stomach eaten into holes by that very substance which had formerly occasioned only pleasure, and been the means of supplying the whole body with health and strength. Even during those long fasts of the savages we have above alluded to, and when, if secreted at all, the gastric juice might be supposed to have a double energy, from its concentration, it does not attack the living stomach. The instant, however, vitality ceases, these agents enter again into the full possession of all their chemical powers, and the dead body is corrupted by those laws of chemical affinity which are suspended during life. It is not our business to inquire into the nature of that principle which thus exercises such powerful control over the active chemical properties of matter; but we may observe, that it results from some experiments of Mr. Wilson Phillip, that this part of the process of digestion may in part be imitated by galvanism. We speak from recollection, not having the work at hand, in which we read an account of these experiments, and as far as that serves us, we believe it was found that on dividing the nerves which went to the stomach the process of digestion was stopped, and again carried on when the stomach was supplied with a stream of galvanic electricity. It may therefore be supposed, that as the electric fluid is only produced by the contact of some particular substances, that it requires the presence in the stomach of some substances to produce the nervous fluid, and perhaps excite the energies of the gastric juice. What we chiefly know of this agent is certainly very little, and amounts principally to the fact of its dissolving almost all dead substances, while it has no action on the living stomach.

Of course a fluid possessed of such remarkable powers has keenly excited the curiosity of philosophers; but it is very difficult, if not impossible, to obtain it in a state of purity. Spallanzani's plan was, to kill an animal after it had fasted a long time, and collect the juice he found in its stomach. He also made animals swallow small metallic tubes, pierced with holes, and containing pieces of dry sponge; on these tubes being vomited up, the juice was squeezed out. He also excited vomiting in the morning, when his stomach was empty, and obtained, at one time, 1oz. 32grs. of liquid, but the pain was too great to repeat the experiment. Mr. Goss, who could excite vomiting by swallowing air, employed this means to obtain the gastric juice. Spallanzani also observed that eagles throw up a quantity of liquid every morning, which he considered as gastric juice, and therefore collected it in considerable quantities. Dr. W. Phillip killed a rabbit about two hours after feeding it, and on squeezing the food in the stomach, obtained a reddish brown fluid, which reddened litmus paper, and coagulated milk. By neither of these modes is it possible to collect the gastric juice in a state of purity, and consequently there have been several different opinions given as to its nature. It has sometimes been said to be acid and sometimes alkaline, sometimes bitter and sometimes salt; in short, the researches into its chemical nature have thrown no light whatever on the cause of its extraordinary solvent power. It has, however, been ascertained that the gastric juice attacks the surfaces of bodies, unites with them chemically, and cannot be separated by filtration. The more the food is divided the greater the energy of the gastric juice, and the food is entirely changed in its taste and smell. Indeed, all its sensible properties are altered; it becomes a pulpy mass, in which the different articles taken into the mouth can no longer be distinguished, and is now called, as we have already stated, chyme.

It is further deserving of notice, that the fluid contained in the stomach of oxen, calves, and sheep,

invariably contains phosphoric acid; and this fluid, and even the inner coat of the stomach itself, has the property of coagulating milk and the serum of blood. Dr. Young found that seven grains of the inner coat of a calf's stomach infused in water, gave a liquid which coagulated more than 100 ounces of milk; and yet in all probability its own weight was not much diminished. What this coagulating substance is, has not been ascertained; but it was furnished by a calf's stomach after it had been washed with a solution of carbonate of potash. An almost imperceptible quantity of some substances seems sufficient to coagulate milk. Mr. Vaillant mentions, in his Travels in Africa, that a porcelain dish which he procured, and which had lain for some years at the bottom of the sea, possessed the property of coagulating milk whenever any was put in it; yet it communicated no taste to the milk, and did not differ from other cups.*

The chyme passes from the stomach by the *pylorus*, or inferior orifice, into the intestines or guts. From inequalities in size, the intestines are spoken of as plural, and called large and small; but, in fact, *they* are only one long cylindrical canal, which begins at the inferior orifice of the stomach, and after winding in various directions, terminates in the *anus*. In general, this canal is altogether about six times the length of the body, but in persons of short stature its proportional length is greater, and in tall persons less. This long canal is anatomically divided into small and great intestines; and the former, which begin at the stomach, are again divided into three portions, called the *duodenum*, the *jejunum*, and the *illium*; the latter are also divided into three portions, called the *cæcum*, the *colon*, and the *rectum*. In the *duodenum* the chyme is mixed with two separate juices, secreted by two very different organs, and differing much in their nature and properties. The first of these is the bile, which is discharged only when the stomach is full, into the duodenum. It is also known by the name of gall. It is a yellowish-green coloured liquid, has an unctuous feel, a bitter taste, and a peculiar smell; it is secreted by the liver, and collected in the gall-bladder as in a reservoir, and seems to undergo some alterations there. By the analysis of Berzelius, 1000 parts of it consists of water 908.4, picromel 80, albumen 3, soda 4.1, phosphate of lime 0.1, common salt 3.4, phosphate of soda with some lime 1. The other is the pancreatic juice, which is secreted by a peculiar gland, resembling the glands which secrete the saliva. This fluid has not been closely examined, but it very much resembles saliva. The alterations produced on the food by it and the bile, we must reserve for our next Number.

(*To be continued.*)

* This statement of Vaillant's may be doubted; for he is not in general considered as adhering very closely to truth.

THE BAKERS DEFENDED.

ADULTERATION OF BREAD.

To the Editor of the Chemist.

Sir,—I read with pleasure the letter of your Correspondent, "A Confiding Man," relative to the adulteration of bread, and I trust you will allow me, one of the trade, to say a few words directly in favour of the bakers. I beg to call the attention of your readers, in the first place, to the species of adulteration made such a great crime of by J. Maton. "The mixture," he says, "of these unfortunate captives' bread consisted of *wheat*, *barley*, *rye*, *oats*, *beans*, *peas*, and *caravanseras*, to which were added *leaven* instead of *yeast*, and *seawater* was used as a substitute for *salt*." Now, Sir, of these unwholesome ingredients, take notice that barley constitutes, or did when I was in that part of England, twenty years ago, the chief ingredient of *bread* of all the peasantry of the north of England, particularly of Lancashire and Derbyshire. Rye,

Sir, as you are no doubt informed, is almost the only ingredient ever used for bread by the peasantry throughout the north of Europe, and probably was a better substance than the *poor* pitied prisoners had ever before eat. Oats, either as meal or bread, is the food of half Scotland; and I myself have eaten bread made both of peas and beans in various parts of England. As for the caravanseras, I know nothing of them, but there seems in them nothing unwholesome. When James Maton talks of *leaven* being an adulteration instead of *yeast*, the said James shows his complete ignorance even of his own trade. Leaven is employed instead of yeast in the greater part of Europe; and is in every respect preferable, giving the bread no bye taste, and being, as every body except James Maton seems to know, nothing but a part of the old batch, become sour from fermentation. There are two reasons why leaven is not generally used, but neither of them derived from any unwholesome properties it possesses. It is very difficult to manage, so as to have it always of the same strength, and to diffuse it equally through the bread; and it is somewhat more expensive than yeast. I say nothing of the salt water, because—the ingredients it contains more than *common salt* render it somewhat disagreeable; but, at the same time, there is nothing unwholesome in it. In making these few observations, Sir, I am far from taking on myself the defence of Dr. ——: there can be no excuse for a man engaging to supply one article, and roguishly supplying another; but I do mean, from James Maton's enumeration of the ingredients with which the doctor-baker adulterated his bread, to infer that he has no knowledge of bread being adulterated with unwholesome articles. A great cry is made by Maton and others against potatoes, Sir. Admitting that they are used, is there any thing unwholesome in them? Ask the Irishmen; ask the poor peasantry of now, nearly all England. Are they poisoned by potatoes? Will any body suppose that washing, grinding, and baking them into bread, instead of boiling them, makes them unwholesome or unpalatable?—We are also accused of using alum, but I, for one, never use it in such quantities as can injure the stomachs or the health of my customers.

Having thus mentioned most of the articles with which we are accused of adulterating the bread, I beg to ask who it is that is now trying to alarm the public, and raise a sort of persecution against the bakers, such as was formerly carried on against corn-dealers?—Why, first comes James Maton, who volunteered as a government spy on army contractors, and so displeased even his employers, that he soon got dismissed; a man who, by his own statement, was for many years daily in the habit of practising frauds, and seems at length to have resolved on exposing the pretended frauds of other people, that he might gain something by it. And will the public allow the statements of such a man to beget mistrust in all classes, and excite a sort of persecution against us bakers? Another great detector of adulteration, and whose book has given rise to most of the outcry, was Mr. Fredrick Accum, an operative chemist. I do not know that this man was engaged in those tricks he describes, but I do know that he was obliged to leave this country for any thing but honesty. In common with other literary men, he was allowed access to the books of the British Museum, and he was accused of mutilating those books, cutting out whole sheets, and thus injuring those valuable works which he was permitted to read. He did not, I believe, wait for his trial; and thus he was saved from appearing at the bar of the Old Bailey. On the statements of such characters, a whole trade is accused of all sorts of base treachery; of ruining the health and sacrificing the lives of their customers, making them have recourse to the doctor instead of

the baker, for the mere sake of a little temporary gain. I trust it is only necessary to remind the public of these facts, to make it at least as suspicious of such averments as of our honesty, and that it will not suffer designing men to work on its fears, to the ruin of all confidence and all security.

I am sorry, Sir, to notice so respectable a paper as the *Examiner* lending itself to this outcry. The motive of its Editor is, however, obvious: he detests the corn laws; he sees in them the means of enhancing the price of bread, and thus begetting the temptation to adulterate it, and, regardless of other consequences, he magnifies the evils of the adulteration that he may alarm the public, and thus ultimately procure a repeal of the corn laws. In his object I go heartily along with him. I know that in proportion as bread is cheap, more of it is consumed; that we want less money to carry on our business; and that it is the interest of every honest baker that he should pay the smallest possible sum for his flour; but I cannot go along with him in the means he employs to accomplish that object; and to me it seems a greater evil to sow mutual distrust and suspicion in the industrious portion of the community than even to eat dear bread. To show him that he is imposed on, I may just refer to his test of good bread, namely—"that it will keep *moist* for several days." Why, Sir, so will pudding, so will the rye *pumpernickel* of the Germans, for six months; but not the white, light, unadulterated bread of the French. That the bread keeps moist for several days is a pretty good sign that it has not been sufficiently fermented nor sufficiently baked; and I leave it to the common sense of your readers to decide whether loads of half-fermented, half-baked dough are not as pernicious and as indigestible as any thing we are unjustly accused of fabricating. I hope, Sir, that you will be of the same opinion, and assist, by the insertion of this letter, in defending us from unjust accusations, and in protecting the community from the ill effects of their own unfounded suspicions.

A Baker.

SUPERSTITION AS TO LIGHTNING.

We seldom perhaps remark the moral effects produced by scientific discoveries and improvements. Since the identity of lightning with electricity has been traced, nobody has thought of attributing the death occasioned by it to the *wrath of heaven*, any more than of attributing the small-pox or the scarlet fever to the same cause. This was formerly however a very general opinion. "*Places*, (says Gibbon,) struck with lightning, were surrounded with a wall, *things* were buried with mysterious ceremony. In the year 283 A.D. Carus, the Roman Emperor, made a successful invasion of Persia; but was then killed in his tent. It was rumoured among his troops that his death was occasioned by lightning; but though no tumult ensued in the camp, it was found impossible to follow up his career of conquest. The legions, however strong in numbers and discipline, were dismayed by the most abject superstition. Notwithstanding all the arts that were practised, it was found impossible to remove the opinion of the multitude, and the *power of opinion is irresistible*. Places and persons struck with lightning were considered by the ancients with pious horror, as singularly devoted to the wrath of heaven. The troops, terrified by the fate of Carus and their own danger, called aloud on young Numerian, his successor, to lead them away from this inauspicious scene of war. The feeble Emperor was unable to subdue their obstinate prejudice, and the Persians wondered at the unexpected retreat of a victorious enemy."

INSTANTANEOUS CRYSTALLIZATION.

Put into two ounces of boiling water as much sulphate of soda

(Glauber's salts) as it will dissolve (about 3 ounces.) While this saturated solution is still boiling hot, pour as much of it into a phial as will nearly, if not quite fill it, cork the phial closely, and let it stand to cool; when it is perfectly cold, the solution still remains fluid; but, draw the cork, and that instant the whole will become a confused crystallized mass, and will evolve a considerable quantity of heat. Hot water dissolves more sulphate of soda than cold water; and had the saturated hot water been allowed to cool, exposed to the pressure of the atmosphere, it would gradually have deposited a part of the salt. But by cooling the water in a close vessel, it is able to hold the whole of the salt in solution. As soon, however, as the cork is withdrawn, the water can no longer hold the salt, and crystallization instantly takes place. After the salt has crystallized, it may be again dissolved by the phial being plunged in boiling water; if then corked, the same experiment may be repeated. The solution of the salt will thus serve for any number of times.

USE OF HOLLOW BONES IN BIRDS, AND BLUBBER IN WHALES.

The large cavities of birds, and the interior of their bones, are filled with air; thus they are rendered light and buoyant, capable of raising themselves into the higher regions of the atmosphere, of sustaining themselves with little effort in this rare medium, and of cleaving the skies with wonderful celerity.—Humboldt saw the enormous vulture of the Andes, the majestic condor, dart suddenly from the bottom of the deepest valleys to a considerable height above the summit of Chimborago, where the barometer must have been lower than ten inches. He frequently observed it soaring at an elevation six times higher than that of the clouds in our atmosphere. This bird, which reaches the measure of fourteen feet with the wings extended, habitually prefers an elevation at which the mercury of the barometer sinks to about sixteen inches.

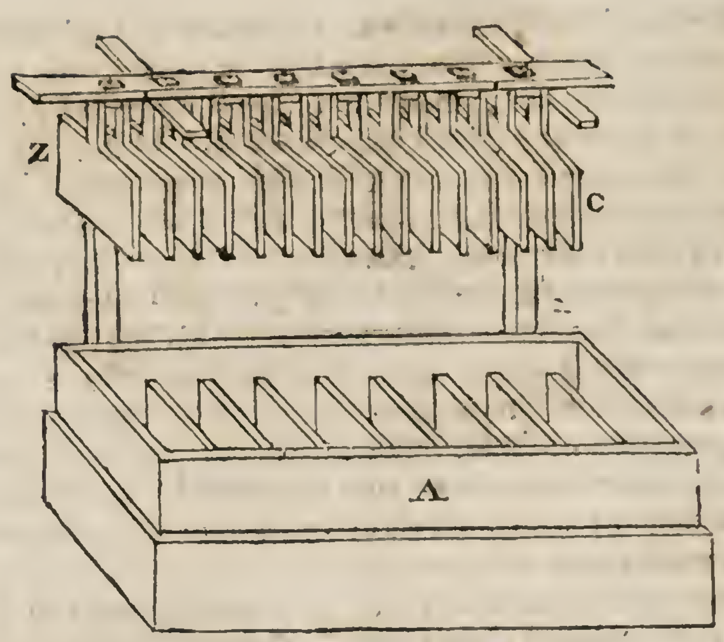
The mammalia, which live entirely or principally in the sea, as the whale kind, the walrus, the manati, and the seals, are rendered buoyant in this dense fluid by a thick stratum of fat laid over the whole body under the skin. From this, which is called blubber, the whale and seal oil are extracted. The object of this structure in lightening these huge creatures, and facilitating their motions, is obviously the same as that of the air-cells in birds in relation to the element they inhabit.

MASKS FOR FIREMEN.

Sir Humphry Davy has shown that metallic wire gauze stops *flame*, by cooling it below the point of ignition; firemen should, therefore, when they are going close to a flame to work for a short time, be provided with masks made of wire gauze, which, to a certain point, would so far cool and extinguish the flame, as to keep them harmless. Perhaps, for a very hazardous exertion, firemen should even be wholly inclosed in fine wire cages. We know that to most of our readers this may appear an extraordinary recommendation; but surely the same circumstance which prevents flame passing *out*, as exemplified in the safety lamp, will prevent it passing *in*, and the masks recommended are on this principle.

TO EXTINGUISH FLAME.

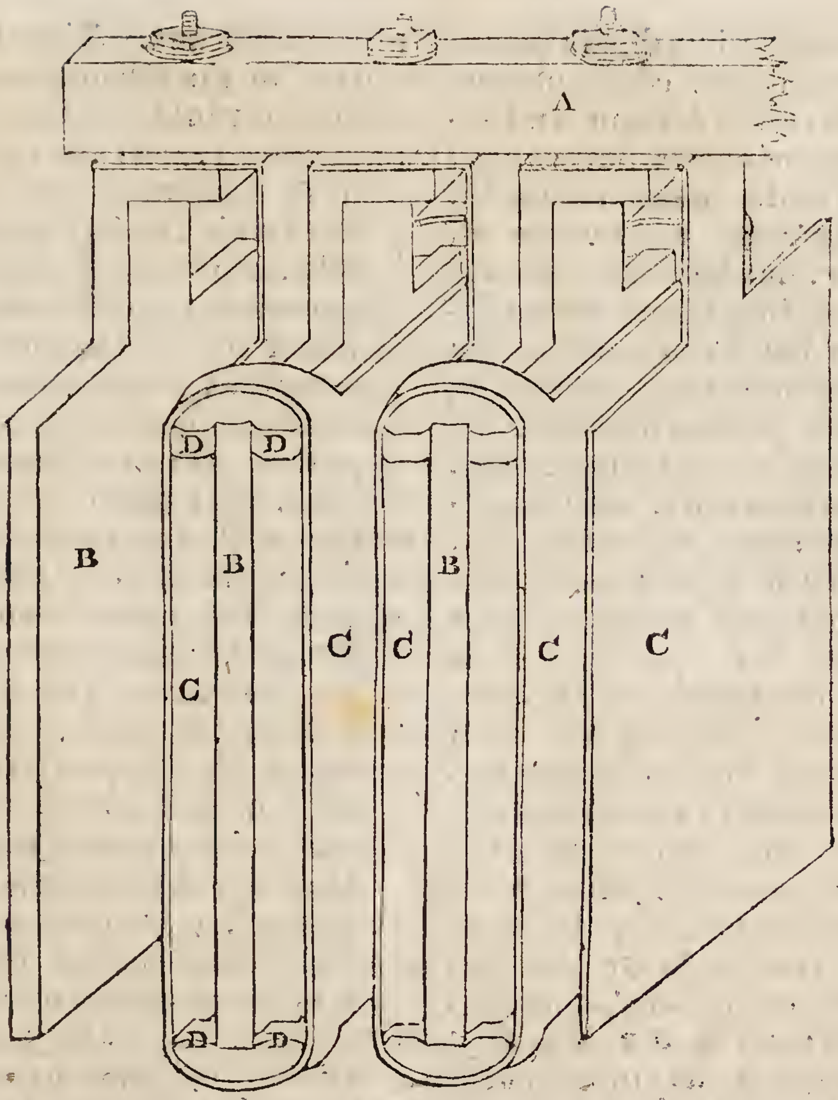
The same principle suggests a means of circumscribing the action of fire. If we can surround a burning spot with a *wall* of wire gauze, we shall prevent it passing through the gauze. Each fire office might be provided with some hundred square fathoms of this substance; and if there be any truth in that principle, which has created the safety lamp for the miner, whenever a case occurred that the fire could be wholly surrounded with the gauze, or the gauze could be placed on one, two, or three, sides of the flame, the flame would not extend beyond it. The firemen might thus securely approach it, and having still all their present means, more speedily extinguish it.



LECTURES AT THE ROYAL INSTITUTION.

GALVANIC ELECTRICITY.

Lecture 11.—I have shown you, gentlemen, Mr. Brande said, in my former Lecture, that the disruption of bodies, and their being ground to powder, produces in them opposite states of electricity. When this is the case with metals, it is invariably found that the most oxidizable of any two metals always acquires positive, and the least oxidizable negative electricity. If we place ever so many series of the different metals in contact, we shall not increase this effect; but it occurred to Volta, that if a series of metals were to be rendered electric by induction, there would be an accumulation of electricity. Accordingly, if we place a plate of zinc and copper with a piece of moist paper between them, we get such an increase of electricity, as to make it manifest by the electrometer. A very ingenious instrument of this description is the electrical column, invented by De Luc. It consists of a great number of small plates of silver, tissue paper, and zinc, placed alternately, and inclosed in a glass tube. When the number of discs or plates is great, as 300 or 400, the electricity which is excited becomes very sensible; and it is found that the end terminated by zinc is positive, and the end terminated by a disc of silver negative. Such an instrument was employed by the Professor to communicate electricity to an electrometer, and it was found, by examining the electricity with a stick of sealing-wax, that with the zinc end positive, and with the silver end negative, electricity was imparted. When the opposite ends of such a pile are united, there is a constant current of electricity passing between them. If the pile be insulated, its electricity is feeble; and is increased by being connected with the earth by the hand, or rendered not insulated by any other mode. There is in this instrument then the two electric poles, and in the centre plates there is a point where there is no action whatever. It corresponds, therefore, strictly with those conductors or electrics in which electricity is produced by induction, and only differs in the circumstance of there being a perpetual renewal of electricity in the pile. On this principle several pretty toys have been constructed. A connexion is established between the two ends of the pile, and some instrument forms part of the circle which, by its motion, sets bells a ringing, and keeps them, by the continued passage of the electric fluid, continually in motion. It has hence been called the electrical perpetual motion, and the thing makes a very pretty toy. The activity of this column is greater in dry frosty weather than in warm damp weather; and here, as in other cases, the law holds good of the least oxidizable metal forming the negative end of the pile, while the



most oxidizable metal forms the positive. By multiplying the discs, or connecting pile, the power of the instrument may be increased, its greatest singularity being that of constantly renovating or renewing the electricity.

The pile of Volta is constructed on the same principles as De Luc's electrical column, only Volta, instead of tissue paper, used moistened pasteboard; and it is found, that if the pasteboard be moistened with salt and water, or a weak solution of acid, that the effect is greatly increased. It will then exhibit sparks, and give shocks, with all the other phenomena of electricity. This then is Volta's pile; the two ends are differently electrified, and the centre remains neutral, so that it corresponds exactly with conductors electrified by induction. Mr. Brande placed a few plates of zinc and copper, and strips of flannel, moistened with a weak acid, on one another, and they immediately produced sparks when the two poles or ends were connected, and exhibited the other phenomena of electricity. The *couronne des tasses* was another instrument invented by Volta, for exhibiting galvanic electricity. It consists of a number of small glasses placed round a plate, and filled with a weak acid solution, into every pair of which a piece of zinc and silver wire are inserted, not so that they touch each other, but in such a manner that the zinc of the first glass may communicate with the silver of the second, and so connect the whole series. On first immersing these metals in the acid, the silver wire is not observed to produce any action; but if the ends be united, bubbles of air immediately rise from the silver wire as well as from the zinc wire, showing the remarkable fact, that bodies acquire new chemical properties by electricity. The Voltaic pile not being very convenient, a different arrangement of the same materials has been since adopted; namely, metals and acid solutions. Sometimes the metals have been soldered into

a wooden trough; but this is inconvenient, on account of the necessity for emptying the trough whenever the instrument is not wanted for use. In the most approved plan, the troughs are made of earthen-ware, having partitions for the plates. Of this form of the instrument, which is that used at the Royal Institution, and of which its great battery is constructed, we subjoin a sketch:—A is the trough, made of earthenware, with partitions of the same material; Z C are the series of zinc and copper plates, which are attached to a rod of wood B D, so that they can all be immersed and removed at one operation. It has been found however by Dr. Wollaston, that the quantity of electricity is increased by extending the copper, so as to oppose it to every surface of the zinc, as seen in our second cut:—A is the rod of wood to which the plates are screwed; B B are the zinc plates, connected as usual with the copper plates C C, which are doubled over the zinc plates, and opposed to them in every direction, but contact of their surfaces is prevented by the pieces of wood or cork D D. It is better, then, if the plates be disposed in this manner, and they actually are so disposed in the batteries now used at the Royal Institution. The troughs contain a solution of sulphuric and nitric acids and water, in which the plates are immersed whenever the instrument is required for use, and are removed the instant it is no longer wanted. To construct a Voltaic battery, several of these troughs are placed near each other, their ends being connected by means of plates of copper. When from 500 to 1000 double plates are arranged in this way, and rendered active by being immersed in a solution, of one part nitric acid, one part sulphuric acid, with sixty parts of water, the most brilliant effects are produced. If the object is to obtain a large quantity of electricity, it is best effected by using large plates; if intensity is required, the plates must be proportionally numerous. The plates employed at the Royal Institution are about four inches square; and during the early part of the lecture, a battery consisting of 16 troughs, each of which had 10 pairs of plates, had been prepared outside of the lecture room, and the wires brought in under the seats, and carried to two upright stands, provided with insulating handles, immediately opposite the Professor. After stating, that when the wires connected with the opposite poles of such a battery were properly united, the most brilliant effects were produced, he brought a piece of charcoal, attached to the negative wire, to touch another piece, united with the positive wire, and a most brilliant light and intense ignition immediately ensued.

As the preparations had been concealed, or at least not noticed, the suddenness and brilliancy of this effect astonished the whole of the spectators. The light and heat produced by this mode exceeds, perhaps, Mr. Brande observed, the light and heat produced by any other means. Care must be taken in handling this apparatus, for it gives shocks like the common electrical machine, which are more dangerous, because the electricity is continually renewed. With a powerful battery, the sparks can be transmitted eight or ten inches through rarefied air. A glass globe, having a piece of charcoal in it, was exhausted by the air pump; and on the connexion being established with the machine, the charcoal was consumed at a considerable distance. Heat and light, then, with sparks and shocks, and all the phenomena of common electricity, are exhibited by the Voltaic battery. Metals have been consumed by the effects of the common electrical machine, and so they might be by the Voltaic battery. Some quicksilver was first exposed to the action of the Voltaic electricity, and was instantly fused. Gold leaf burnt brilliantly, and silver leaf with a fine pale green flame. Iron wire, and copper and tin foil, were set on fire the

moment the communication with them was established. Two curious experiments, which we shall more particularly notice, were the following:—The two ends of the conducting wires of the battery were placed 8 or 10 inches apart, and a connexion formed between them by a piece of iron wire, which became instantly red hot through its whole length, and the next instant was totally dissipated. When the connexion was formed, however, by a piece of wire, composed of pieces of platinum and silver, alternating with each other, the pieces of each being about two inches long, the platinum only became ignited, and the silver was not affected, so that the space between the points was marked by a line alternately ignited and dark. This different effect is attributed to the difference in the conducting power of the two metals: the silver allowing the electrical matter freely to pass, while the platinum opposes its passage long enough to become ignited by its stay. The two points of the conducting wires were then applied to the electrometer, and the suspended gold leaves below were instantly consumed. During these operations, it is found that the metals connecting the two points become magnetic. That a steel or iron wire should become so, may excite some surprise, as tending to show some connexion between electricity and magnetism; but it is found, that when copper wire forms the connexion, which in its usual state exhibits no magnetism, it is also rendered magnetic in its whole length, and attracts iron filings at every point during the passage of the electricity. This was proved by extending a copper wire between the points, when it was found to attract the iron. These were all the facts connected with the production of light and heat by this instrument, which Mr. Brande thought it necessary at this time to bring under the notice of his class, saying he should then pass to consider of the chemical phenomena.

If the connexion between the two poles of the battery be made by compound substances, they are decomposed. If water be made the medium of connexion, the hydrogen, which is one of its elements, is attracted by the negative pole, and the oxygen by the positive. As it is a general principle, that bodies similarly electrified repel, and differently electrified attract each other, it has therefore been supposed that the natural electrical state of oxygen is negative, and that of the hydrogen positive, or that the natural electrical states of these two substances is opposite from that of the poles at which they are evolved. Water was submitted to the action of the battery and rapidly decomposed, the gases being collected and afterwards detonated again, forming water by their combination. If the water contains any saline matter, it is decomposed at the same time, and the acid evolved at the positive pole, and the alkali at the negative. In the earliest experiments which were made on the decomposition of water by electricity, it was found, whatever care might be taken to distil the water, so as to have it perfectly pure, that an acid was always perceptible at the positive, and an alkali at the negative side. As many experiments were made, and the water carefully distilled, without the results being altered, it was concluded, that water also contained the elements of an acid and an alkali. Sir Humphry Davy showed the fallacy of this opinion; and as we are indebted to him for many new and interesting experiments and discoveries to which he was in some measure led by his researches into the truth of this opinion, it may be worth while to trace the successive steps by which he was at length conducted to some of the most brilliant results of modern chemistry.

Sir Humphry Davy found, in the first instance, that the quantity of acid and alkali was diminished, in proportion to the care that was taken to distil the water, so as to obtain it quite pure. It could not therefore be from the water that these substances were derived; but

still, with all his precautions, he found some alkali always produced along with the hydrogen, and some acid along with the oxygen. He was then led to suspect that these substances must be derived from some other sources; and, on closely examining the glass vessels, he found they had been acted on; and as glass contains an alkali, with several other substances, it seemed certain that the elements of the glass were separated, and supplied the impurities. On taking great care in distilling the water at low temperatures, for at high it carries over a portion of the salt, and avoiding even dipping a finger in it, for that will contaminate it, and then making the experiment on water contained in gold or agate vessels, out of the contact of air, Sir Humphry obtained nothing but hydrogen gas at the one pole, and oxygen gas at the other. In proving the fallacy of this opinion, and ascertaining the source of the acid and alkali observed by other chemists, Sir Humphry was led, of course, more closely to observe the decomposing power of the electric fluid; and he concluded, that it might be employed in separating the elements of substances not otherwise decomposable. Sir Humphry observed, however, that while bodies were thus decomposed by electricity, and the elements remained under the influence of the electricity, that their chemical relations were changed or suspended.—[This was shown by an experiment with sulphate of soda, which will appear in our next, with an engraving.]

The most difficult bodies to decompose may thus, as well as those which, like sulphate of soda, are easy to decompose, be resolved into their elements, if rendered conductors by being moistened with water. Here is some sulphate of barytes in powder, and I place it, moistened with water, on two discs of platinum, connected with the Voltaic battery: on each disc I place a piece of litmus paper, to show the effects; and though the discs be separated, if I connect them with this piece of cotton, the decomposition of the salt instantly begins, the barytes going to the negative and the acid to the positive pole. Electrical surfaces, then, decompose substances, one element being attracted by the positive and the other by the negative pole. Sir Humphry Davy, on tracing this effect, ventured to suppose that many substances hitherto not decomposed, might by this agent be resolved into new elements. He tried his conjecture on the alkalies and the earths, and decomposed them, discovering that they consisted of metallic bases united with oxygen. From the above circumstance, also, Sir Humphry Davy has been led to suppose that electrical and chemical phenomena may be dependant on one and the same power, and that chemical affinities may have some relation to the opposite or similar electrical states of bodies. That similar decompositions may be obtained by common electricity, has been proved by Dr. Wollaston, who, by means of common electrical sparks, decomposed the nitrate of silver. Of the theory of all these curious phenomena, gentlemen, the Professor concluded, I mean to speak in our subsequent lecture, in which I hope to terminate all I have to say on Electricity.*

* Perhaps we may here remark, that in general, up to a late period, Electricity and Galvanism have been considered, if not as distinct powers, yet as distinct effects of the same agent. By his manner of treating the subject, Mr. Brande places the connexion between the two in a clear light. We have first the polar electrical state, excited in conductors by induction, and the action of the electrical machine; then comes a precisely similar state, excited in metals by their contact; and then follows the increase of this particular state, by increasing the surfaces of the metals, and producing a chemical action, which constitutes the highest power of the Voltaic battery. We are thus led on, by gradual and successive steps, to see the intimate connexion between electricity and galvanism, the only difference between the two utmost links of the series being, that, in the production of electricity, we observe no change in the chemical properties of the glass and the rubber, while the electricity of the powerful Voltaic pile is produced or accompanied by the chemical action of the acid and metals.

IMPORTANT DISCOVERY. NEW VOLTAIC-MECHANIC AGENT.

In the account we published in the first Number of The Chemist of Sir Humphry Davy's experiments on the condensation of the gases, the Editor observed, that it was to chemistry we were to look for an explanation of those great mechanic powers which carried on the universe. He did not then, however, imagine that it would ever be his lot, in his humble endeavours merely to diffuse a knowledge of the discoveries of others, to be the instrument of enriching science with any of his own. Such, however, he believes, is now the case; and the discovery, if it be one, and can be converted to any useful purpose, as he believes it may to many most useful and important purposes, is so obvious, simple and intelligible, that he is much surprised it should not before have been thought of; and can never be enough thankful, that it was reserved for him to hit on a *thought* which may change and improve the condition of mankind. The great principle is the application of Voltaic electricity to the purposes of producing mechanic power. In the present Number of The Chemist, there is a short and superficial account of an instrument which produces, by the continued production of electricity, a *perpetual,* though not an *equable* motion. This principle has only been hitherto applied to make mere toys. But the Voltaic battery, the most powerful instrument with which science has yet armed the hand of man, presents a continual renewal of the electric current, in the same manner as the pile of De Luc, but in a prodigiously more intense degree. Why cannot we apply this instrument to produce a perpetual mechanical power? The Editor believes we can; and he proposes its application in the following manner:—

All the world has lately heard of Mr. Brown's pneumatic engine, in which the source of the power consists in burning hydrogen, or some combination of hydrogen gas in *atmospheric* air. Mr. Brown finds it very difficult to get rid of the *nitrogen.* But if we decompose *water* by means of galvanic electricity, as every one knows we can, we produce abundance of oxygen and hydrogen, in those exact proportions in which they combine, and, when flame or the electric spark is applied, condense each other, and produce the most perfect vacuum, which perhaps the art of man can form. The Editor of The Chemist, therefore, says, that a new power, hitherto never thought of, never put to any use, may be generated by decomposing water by means of galvanic electricity, and recomposing the resulting gases by means either of flame or the electric spark. By this means we generate a power (*the two gases*) in the first place, equal to an additional atmosphere, and when we have thus generated this atmosphere, we may form a perfect vacuum by inflaming and condensing the gases. We have first a power equal to the atmosphere, which Mr. Brown does not produce; and next we have a far more perfect vacuum than he can possibly form. The volume of the gases is diminished near two thousand times. The application of this power, first to raise a piston, and afterwards to let it fall in the vacuum we create, is too obvious to need, at present, further explanation. Thus, by a continued production of electricity, which is generated by a Voltaic battery, we may go on for ever decomposing and recomposing water, producing, to the end of the world, an enormous power, with apparently inadequate means.—That there are many difficulties in adapting this principle to practice the Editor is well aware; but he is prepared with many means of obviating apparent difficulties, which he cannot at this late period of the week bring forward. To make a principle of this kind succeed, the combination of many heads and many hands are necessary; and he now merely states the outline, in order to stimulate the industry

and ingenuity of all his readers, and of the world, in adapting it to useful purposes. There is no mystery, he believes, hanging over the statement—no quackery; it is plain and palpable, and such as it is he throws it open and patent to all mankind to make the best use they can of it. In his future Numbers, he will mention some of the developments of this principle—some precautions to be adopted; and, in the mean time, he will be ready to communicate further on the subject with any man who thinks it worthy of attention.

NATURAL INGENUITY.

The Greenlander, and the Esquimaux of Labrador, placed in a region of almost constant snow and ice; where intense cold renders the soil incapable of producing any articles of human sustenance, are fed, clothed, and lodged from the seal. They pursue, indeed, the rein-deer, other land animals, and birds; but seal-hunting is their grand occupation. The flesh and blood of the seal are their food; the blubber, or subcutaneous stratum of fat affords them the means of procuring light and heat; the bones and teeth are converted into weapons, instruments, and various ornaments; and the skin not only supplies them with clothing, but with the coverings of their huts and canoes. The stomach, intestines, and bladder, when dried, are turned to many and various uses: in their nearly transparent dry state, they supply the place of glass in the windows; they form bladders for their harpoons, arrows, nets, &c.; when sewed together, they make under-garments, curtains, &c.; and are employed in place of linen on many occasions. Thus every part of the animal is converted, by a kind of domestic anatomy, to useful purposes; even to the tendons, which, when split and dried, form excellent threads. To the pursuit of the seal, the canoes, instruments, weapons, clothing, education, and whole manner of life of the Greenlanders, are adapted. As a plentiful supply of these animals enables them to dispense with every thing else, and as without these they could procure neither dwellings, clothes, nor food, it naturally follows that the great aim of education is to make the boys expert seal-hunters; and that dexterity in this pursuit is the greatest praise that can be bestowed on the man. The Laplanders, and the Tungooses of North-eastern Asia, are equally indebted to the rein-deer; the Tschutski, the North-west Americans, the Aleutians, and other neighbouring islanders, to the whale and walrus. The latter, as well as the Greenlanders, seem to have anticipated modern anatomists in accurately distinguishing the several anatomical textures, and ascertaining what Bichat calls their "propriétés de tissue," or properties resulting from organization, in order to convert the various parts to the manifold purposes of their economical anatomy: they surprise us by manufacturing thread from the carcase of the great leviathan; splitting the fibres of its cutaneous muscle (the *panniculus carnosus*) into lengths of a hundred feet or more; and preparing from it a double threaded twine, which, in the united requisites of fineness and strength, will bear comparison with any productions of European industry.

JUICE OF ELDER BERRIES AS A TEST.

Take any quantity of the ripe berries, picked clean from the stalks, and after having bruised them, press the juice into a clean well-tinned vessel. Add a fourth part of its weight of alcohol, and evaporate the mixture to one-half. Remove it from the fire for ten or twelve minutes, and add as much alcohol as you have of concentrated juice. A copious precipitation of the parenchymatous and gummy parts will take place, which will permit the liquor to be strained with ease through a fine cotton cloth.

The filtered liquor is now fit for use. It consists of the saccharine

and colouring principles of the berries, in solution with alcohol and water. It is of a beautiful violet colour. In order to ascertain its utility as a test of acids and alkalies, the following experiments were made:—

To one pint of rain water a single drop of the tincture of elder berries was added. The blue colour was too pale to be perceived; but the addition of a single drop of sulphuric acid produced a decided red colour.

To the liquor employed in the last experiment, a minute quantity of alkali was added, when it immediately changed to a bright lively green. If a quantity barely sufficient to neutralize the acid be employed, the original blue or violet colour is restored; hence this test possesses all the delicacy of the tincture of litmus, or blue cabbage, and has this additional valuable property of keeping unaltered, during the hottest season of the year. The species tried as above was the *Sambucus canadensis;* the juice of the common elder berry (*Sambucus nigra*) will probably answer as well.—*Annals of the Lyceum of Nat. Hist. of New York.*

SIR HUMPHRY DAVY'S COPPER.

Sir,—In the last Number of the "Annals of Philosophy," there is an article by Mr. Children, the champion of Sir Humphry Davy, on the subject of Ships' Bottoms, and his trip to Norway. With the former only you have to do. And,

1st. Mr. C.'s account of the "two pre-defended" boats in Portsmouth Harbour, is to be met by this fact, that in this dock-yard six vessels have been "Davied;" two of which, the Gloster and the Howe, (the former at anchor since the 12th of July last, and the latter since the 30th of April, both too in a *rapid tide*,) are as foul as it is possible for ships to be; much more so, indeed, than any other vessel in this harbour, being covered with echinæ, barnacles, weeds, worms, muscles, &c.

2nd. This principle of Sir H. Davy's is to preserve copper from decay; but what are the effects resulting from the *attachment* of those animals? Do they not adhere for *subsistence?* and if so, must they not *destroy?*

3rd. Mr. Children says, that "except in harbour, carbonate of lime could not adhere to the copper." Now this is a harbour *with a tide-way*, and yet carbonate of lime does adhere.

4th. Mr. Barrow's evidence on the subject merely amounts to this, that the ships on which the experiments have been made have "not been reported."

I think it would be well in the Admiralty to pause before any more vessels are "Davied."

I am, Sir,
Your obedient servant,
SPYGLASS.

Sheerness Dock-yard, Nov. 1.
Mechanics' Mag.

DICTIONARY OF CHEMISTRY.

Coral. This interesting production is chemically composed of carbonate of lime and animal matter, in pretty nearly equal proportions.

Cork is the bark of a tree of the oak kind, very common in Spain and the other parts of the south of Europe. By the analysis of M. Chevreul, it is stated to consist of *cerin*, a resin, and an oil, with the ligneous matter which is called suber.

Cork (fossil), *mountain cork, elastic asbestus.* A species of asbestus.

Corrosive Sublimate, *deuto-chloride of mercury.* A well-known medicine and poison, consisting of mercury 25 parts, chlorine 29.

Cortical Layers. The innermost part of the bark of trees, or that next the wood.

Corundum, *adamantine spar.* A valuable mineral, found in Hindostan and China.

Cotton. A soft down which envelopes the seeds of various plants, and particularly certain species of *gossypium*, from which the cotton of commerce is procured. Cotton is dissolved by strong alkaline solutions, and it seems never to have been accurately examined by chemists.

Cotyledons. The lobes or body

of seeds which seem to be intended principally to supply nourishment for the young plant.

CRASSAMENTUM, *cruor*. The clot or coagulated part of the blood.

CREAM. The oily part of milk, which rises to the surface, mixed with curd and serum. When churned, butter is obtained from it.

CREAM OF TARTAR, *tartrate of potash*. A well-known medicine.

CRICHTONITE. A velvet, black-coloured mineral, so called in honour of Dr. Crichton.

CROCUS (Saffron.) Formerly the saffron-coloured oxides of iron and copper were called *crocus martis* and *crocus veneris*. The oxide of iron is still called crocus among workmen.

CROCUS METALLORUM. An impure hydrosulphuret of antimony, formerly used to prepare tartar-emetic.

CROSS-STONE, *harmotone*, *pyramidal zeolite*. A mineral found in various parts of the north of Europe, consisting of 49 silica, 16 alumina, 18 barytes, and 15 water.

CROTON ELEUTHERIA, *cascarilla bark*, the *eleutheria* and *cascarilla* of the shops. It is the bark of the *croton eleutheria*, has some resemblance to Peruvian bark, and is distinguished by the smell of musk when burned. Its constituents are mucilage and bitter principle 864 parts, resin 688, volatile matter 72, water 48, woody fibres 3024.

LONDON MECHANICS' INSTITUTION.

ON Wednesday evening, Dr. Birkbeck announced, that on December 2, the first stone was to be laid of the new theatre for this Society. He then invited all the members to attend, as well as all those who had been members, and had now left the Society.

COPAL VARNISH

MAY be made by pouring on the purest lumps of copal, reduced to a fine mass in a mortar, colourless spirit of turpentine, till it stands about one-third higher than the copal. The mixture is to be triturated occasionally in the course of the day; next morning it may be poured off into a bottle, and is fit for use. Successive portions of oil of turpentine may be worked off the same copal. Camphorated oil of turpentine and oil of spike lavender will dissolve the copal without trituration; but this varnish, though good for drawings or prints, will not do for pictures, as it dissolves the paint underneath, and runs down while drying.

TO CORRESPONDENTS.

The first part of the communication of "Tyro Chemicus" seems, in substance, only the repetition of an objection already stated in the Mechanics' Magazine, the writer of which, as well as our Correspondent, quite mistook the circumstance described in The Chemist, as a remarkable exception to a general law. Many bodies expand on crystallizing, but only water, as far as we know, expands as it cools, and long before it crystallizes. The latter part of his letter being a conjecture, we will insert, if he pleases.

R. I. F., from the Forest of Dean, next week.

The Title, &c. is published, W. K. S. We regret your suggestion did not occur to ourselves. The other part of your communication in our next.

The subject mentioned by "Major" is of great importance to all but barefooted Highlanders; though the *snobs*, we are afraid, would be against any improvement. We shall however keep the public interest in view, and do what we can to bring forward some improvement.

"James Edwards" came too late for this week; and, on consideration, we hardly think it necessary to take any notice of the publication he alludes to. We disapprove as highly as he does of Mr. Cooper's little display of momentary vexation; but as his good humour is returned, we have no wish to ruffle it.

"Anti-Suction" recommends our former correspondent, "Suction," not to scald his fingers by dabbling in hot water.

"A Constant Reader, No. 1," had probly better apply at No. 24, Rathbone-place, Oxford-street: we have heard nothing on the subject since the notice was inserted.

⁎ Communications (post paid) to be addressed to the Editor at the Publishers'.

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The Chemist.

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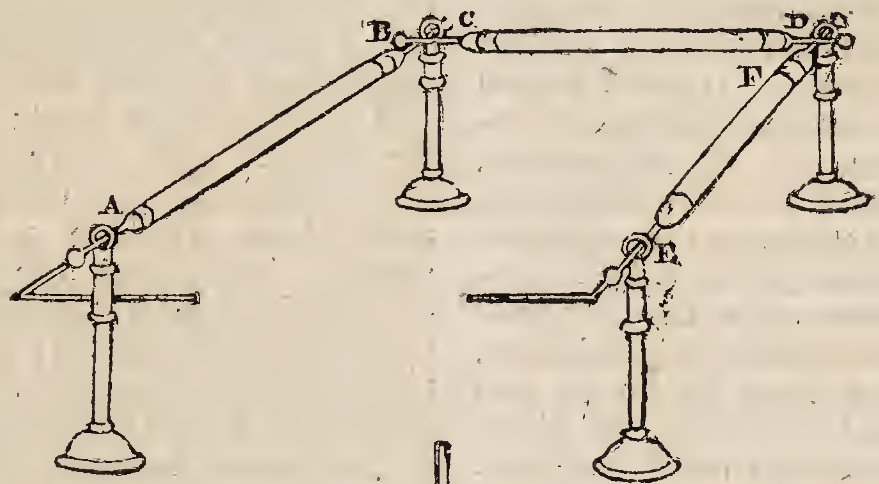

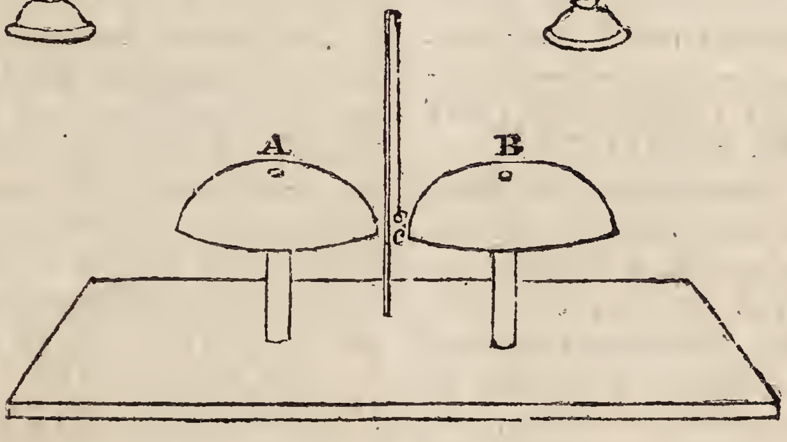

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ILLUSTRATIONS OF PERPETUAL MOTION BY ELECTRICITY.

While M. De Luc was engaged in his experiments, Mr. B. M. Forster succeeded in producing a constant electrical chime, by making the action of the column set in motion a brass ball, suspended by a silk thread between two small insulated bells, connected with the two extremities of a column, consisting of 1500 groups of the same diameter as those used by De Luc.

The apparatus of the bells is represented in our Plate, where A B in the under figure are the two bells, supported on glass pillars, and c the small brass ball which acts as a clapper in ringing the bells. On the 14th of March 1810, Mr. Forster put this apparatus into a closet, and connected it with the three columns A B, C D, E F, represented in the figures above. The bells immediately began to ring, and continued till the 24th March, when the ringing ceased about a minute. It then began again, and continued without ceasing till the 4th of September, when it ceased about ten minutes. They began again to ring at intervals, stopping, perhaps, half a second or more at a time. After this they stopped for several days, and at other times for hours, and on the 18th of November Mr. Forster removed them from the column.

LECTURES ON CHEMISTRY AT THE ROYAL INSTITUTION.

Lecture 12. More clearly to show the source of the Voltaic electricity, and thus lead to a clearer explanation of the theory, the Professor remarked, at the beginning of this Lecture, that if a trough be filled with pure distilled water, and the ordinary metals exposed to its influence, all the phenomena of common electricity are observed in perfection. On substituting acids, which produce a chemical action on the metals, for the water, the quantity of the electricity produced is much increased, while the intensity remains the same. With the water, sparks, though very feeble ones, are produced, a shock may be given, but wires are not melted; there is no intense light and ignition, and none of the effects are observed which are attributed to quantity. As the water has no chemical action, except a very feeble one on zinc, this establishes clearly the identity of the Voltaic electricity with the electricity of the pile of De Luc. On the other hand, with the acids, the shock received by the human body, owing to its being an imperfect conductor, and thus not carrying off more than a certain quantity of electricity, is not greater than the shock from the plates immersed in water. There can be no doubt that the source of the electricity is in both cases the contact of the metals, but the quantity is much increased by the chemical action of the acids. A series of troughs, containing water, a weak acid solution, and a strong acid solution, were placed beside the Professor, and he showed, that with the first only a very feeble spark was produced; with the second, a more powerful one, and considerable heat; and with the third, still more considerable effects. By using strong acids, then, we have a means of greatly increasing the quantity of electricity, and of producing the most powerful effects; but owing to the rapid corrosion of the zinc, when strong acids are employed, it is not usual to make the liquid stronger than one part of nitric and sulphuric acids, and 60 parts of water. With a thirtieth part acid, the effects are very powerful.

It is remarkable in this case, that one of the metals being placed by the contact of the other in an electro-negative state, is not acted on by the acid. When copper and zinc are immersed in the solution, it is the zinc only which is affected; and on this principle it is that Sir H. Davy has applied zinc to copper when employed to sheath ships, to destroy the corrosive effects of the salt-water. By the contact of the metals, the copper is rendered electro-negative, and the salt water ceases to destroy it.

Another circumstance, which influences the quantity of the Voltaic electricity, is the extent of the surface of the plates. The same chemical effects, and the same intensity is produced by small plates as by large; but the quantity of electricity, and its burning effects are much increased by increasing the size of the plates. The Professor then exhibited Dr. Wollaston's method of connecting the plates, which we have given in a foregoing lecture, and by immersing a single pair of plates so connected, about

six inches long and four broad, in an acid solution, and bringing the connecting wires in contact with charcoal, a brilliant light was immediately given out. Although the quantity, then, of electricity is so much increased by the acids, the original source of the electricity is the contact of the metals, and all the varying phenomena with acids and other solutions may be referred to the contact as the original source. Metals are then, as they were called by Volta, electro-motors. Much discussion, however, has taken place, and many different opinions have been entertained, as to the source of the Voltaic electricity, and some persons have attributed it entirely to the chemical action of the acids. The contact of the metals, however, is sufficient to produce the electricity, without this chemical action; but the contact of the acids and their chemical action have an influence on the quantity produced.

The Professor next proceeded to notice some natural electrical phenomena. The first he adverted to was thunder. In thunder-storms, he said, the clouds, as they rise from the earth, become electric, and the surface of the earth is thrown into an opposite state of electricity by induction. The clouds are positive, and the earth negative. If a connexion is established between the two by a conducting medium, the electricity is silently discharged, and no explosion or effect is perceptible; or the equilibrium may be established by a sudden explosion, and then lightning and thunder are perceived. We have an example of the former in clouds gathering round the summits of mountains, to which they seem wafted or attracted, and are dissipated there; or, having discharged their electricity, are again sent off. The discharge may take place from the cloud to the earth, or from the earth to the cloud; in either case we may see lightning and hear thunder, which is occasioned by the disruption of the air. The sound will be first heard by the spectator from that part of the air nearest him which is agitated, and will gradually proceed from the points in the line of the discharge furthest off, till the sound proceeds to him from the spot where the air is first set in motion. Thus the sound comes from different distances to the person who hears it; and the air, being of unequal density, is from this and other causes unequally disturbed. Hence, the reverberations and different intensities of sound which distinguish thunder from the firing of cannon, and hence also the zig-zag appearance of the lightning.

The danger from these natural discharges of electricity is in proportion to their proximity. If a person forms part of the conducting medium, he receives a shock, is deprived of his breath, and sometimes death ensues. But there are peculiarities which modify these effects, that have not yet been all explained. In the course of the year before last, a man on horseback, in some part of Kent, was struck by lightning, his horse was killed, he was thrown off, but escaped without any considerable injury. If we are out in a thunder-storm, and are exposed to any danger, the best means of ensuring our safety, is to throw ourselves on the ground. Trees, being elevated objects, are likely to attract the electric fluid, and are good conductors, particularly the soft moist part, just under the bark; but trees are not such good conductors as the human body, and while they attract the electricity from the clouds, they may impart it to those standing beneath them. To go under them is therefore dangerous. In houses, the various conducting substances about make the danger less. The lead about the roofs, and the leaden spouts, which are employed about houses in London, are good conductors, and carry off the electrical fluid. Steeples are imperfect conductors, but the lead and iron cramps with which the stones are fastened are conductors, and sometimes every one of them is destroyed. If we are in an apartment, and suppose there is danger, the best

situation is the middle of the room, and not near the fire. In an exhausted receiver electricity passes very rapidly; on this principle, a current of heated and rarefied air passing up the chimney is a good conductor, and therefore there is danger near the fire-place. Bell-wires, and such things, are good conductors, and may be fused by the passage of the electricity. For powder works, and such buildings, the conductor should be near the building, and should be inserted so far in the earth as the part where it is generally wet, or it should terminate in a pond of water. The conductor should be sufficiently thick not to be liable to fusion. The *aurora borealis,* also, is an electrical phenomenon, depending, no doubt, on currents of electricity in the atmosphere; but with them there is only light, and no explosion. The Professor said, he was not aware that any new facts relative to this phenomenon had lately been brought to light, but an ample account of it may be found in the accounts of the late voyages to the North Pole. There are also two electrical animals: the *gmnotus,* or electrical eel; and *torpedo,* or electrical ray—on which a few words may be said. It has been long observed, that electricity may be obtained from animal substances: it is only necessary to place some possessing different conducting powers in contact. In the two animals mentioned, there are organs which, by their structure, have a great analogy with the disposition of good and bad conductors. In them it is very remarkable that the supply of nerves to these organs is very great, ten times more, proportionately, than to any other part of the body. On the organ being frequently called into action, the animals are observed to become very much debilitated; and it has been shown that the organ may be extirpated, without the animal suffering, apparently, any inconvenience. From these circumstances, some physiologists have supposed that the nervous fluid, as it is called, and the electrical fluid, are the same; and it has even been conjectured, that the reason why some of the secretions of the body are acid and others alkaline, which is the case, is that the secretory organs are in opposite states of electricity. It has been supposed also, that the brain possesses some analogy to a Voltaic apparatus, and serves the purpose of producing and distributing electricity, by means of the nerves, to the various parts of the body. Of this, however, there is no proof; it is mere conjecture, and much is yet to be learned before we can ascertain with precision what are the exact functions of the brain.

It has been long observed, that if common electricity is made to pass through magnets, that they lose or change their polarity; but this was supposed to be only a temporary effect, till Professor Oersted, of Copenhagen, in 1819-20, discovered that interesting class of phenomena to which the name of electro-magnetism has been given.

For the experiments connected with *electro-magnetism,* which are very delicate, a considerable quantity of electricity is necessary. On placing a common magnetic needle, freely suspended, under a wire proper to communicate with the two poles of a Voltaic battery, as long as the connexion is not established, the needle points correctly north; but the instant the connexion in established, it is drawn out of this direction, being affected by the electricity; and as this continues, its poles are entirely reversed. If the connecting wire be placed in a line with the magnetic meridian, and the needle, freely suspended, be placed beneath it, it is immediately thrown into convulsions, and declines from the magnetic meridian, in proportion to the strength of the electricity, so as to become, at the greatest degree, at right angles to it. At the same time another effect is observed, which is, that the needle inclines in a vertical direction, or dips, with regard to the horizon. It would seem from these facts, that there is in the magnetic needle, supposing it to be free to move in every direction, a dispo-

sition to revolve, according to the motion of the electrical current, and according to its own situation with regard to the electrical poles. The hypothesis on which these actions were accounted for, supposed that there was a current of magnetism set in motion, in opposition to the current of electricity. It is a fact, as has before been pointed out, that the metallic wire, connecting the two poles of the battery, or carrying electricity, is made strongly magnetic, and it is of no consequence of what metal that wire is made. The wire which is here the conductor is of copper; and you see, as I sprinkle these steel filings over it, that it retains them in every part of its length; but the instant I destroy the connexion with either pole of the battery, the steel falls to the ground, or the copper wire loses its magnetism. This experiment was made, and the results were as stated. If a needle be placed in the line of the conducting wire, it is observed to acquire polarity. The influence extends also to some distance, and may be carried through water, forming part of the electric circuit. The same effects are observed of common electricity. If a needle, freely suspended, be placed with its centre over the conducting wire, the north pole of the needle will immediately deviate from the magnetic meridian, and it will decline towards the east, over that part of the wire which is nearest the copper end of the Voltaic pile, or the negative electric pole; if the needle be placed under the conducting wire, a deviation also takes place, but in an inverse direction, the north pole tending towards the west. Thus then the electrical current appears to influence the magnet in a circular direction, carrying the same pole of the needle towards the east while over the wire, and towards the west under it. If the electrical conducting wire be formed in a spiral direction, its power of imparting magnetism is much increased. A bar of steel, not at all magnetic, on being placed in a glass tube for a single minute, around which the conducting wire is spirally wound, becomes powerfully magnetic. Supposing the electric and magnetic currents to move in a circular direction, and each to influence the other, Dr. Wollaston conjectured, that two magnets, freely suspended in space, and offering different poles to the electrical current, would be made to revolve constantly in an opposite direction. He did not succeed in making the experiment, but Mr. Faraday did, and by a delicate contrivance, had realized Dr. Wollaston's conjecture.

Electricity has also been excited by merely heating metals. If one end of a metal bar be heated while the other remains cold, it becomes electrical. If two metals be united or twisted together, and heat be applied, the effect is greater. The effect produced on magnetic needles by electricity has become a delicate index of its presence, and by employing them, this sort of electricity, which has been called *thermo-electricity*, can be made evident. Mr. Brande made two or three experiments with magnetic needles, so suspended that they might revolve by the currents of thermo-electricity. It was only the metals that displayed any signs of thermo-electrical effects; other bodies, such as salt and water, were decomposed, and not rendered thermo-electrical. In conclusion, Mr. Brande observed, that he had then brought to a close all the observations which the shortness of the time allowed him to make on this interesting branch of science. He had treated it principally as far as it was connected with chemistry, and in the next lecture he should begin to treat of Radiant Matter.*

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* It is rather a favourite opinion of ours, that all the general prejudices in which our species have from time to time indulged, have had a broad foundation on some principle of truth. There is always at the bottom of them some fact, which all recognise, but which is either misunderstood or perverted. Mr. Brande, in speaking of alchemy, in his introduction, justified this opinion in one remark-

able instance; and the case of electricity may perhaps furnish equally as good an illustration of the substratum of truth which was at the bottom of the prevalent belief in magic of olden times, as the change of the properties of some metals furnished a justification for the credulity of the alchemists. Must not many of the facts stated in these Lectures appear magic to the uninitiated? May some such facts not have been discovered, and left unexplained, ages ago? And may not they who produced them, without being able to tell how, have naturally supposed they possessed powers more than other men? And must not those who beheld any wonders like these have been impressed with a belief that there was "more in heaven and earth than was dreamt of in their philosophy"? May we not find also a rational explanation of the method of performing incantations and magical experiments during storms, in what is then usually the electrical state of the atmosphere? Without being at all fantastic or dreamy, it may also be observed, that the whole of nature is unexplained *magic;* and nothing but the great familiarity and the frequent occurrence of the same phenomena, and the invariableness of the results, preserves us from having all our faculties suspended by astonishment. The more nature is examined, the more unsatisfactory do all the theories which pretend to account for every thing appear, and the more reason there is for wonder. Thus, in speaking of the expansion and contraction of bodies by heat, Mr. Brande observed, that this circumstance had been urged by philosophers as a proof that none of the particles of matter were in contact; and it has been proved, that it requires a considerable force to bring two plates of glass within a certain distance of each other, and that they may be broke to pieces by an additional force, but cannot be made absolutely to touch. We cannot suppose that our hands overcome that resistance which crushes the glass to atoms, and consequently we *feel* only that *repulsion* which keeps the particles of matter asunder. But we never see this repulsion; and consequently, though in common language we talk of seeing and feeling the same object, this is not philosophically correct. We never *feel* the colours which we *see*, and we never *see* the repulsion which we feel; and the only explanation we can arrive at is, that certain sensations of touch or of sight, are signs, constant and never failing signs, however, when we shall also experience certain other connected sensations of sight or of touch. This is the reason why the true philosopher says, the further he pushes his inquiries, the more he is lost in astonishment; and why he is not ambitious to frame theories to account for numerous secondary facts. He is careful to observe these facts, and class them together by their resemblance, or apart, by reason of their dissimilarity; but as he knows there are such ultimate facts as those above mentioned, which he cannot possibly explain, he is patient in his ignorance of the cause of secondary facts, and does not seek to veil this ignorance from himself by the invention of a term, nor impose his theories on others as substantial knowledge. We consider the terms *electricity*, *caloric* or *heat*, *chemical affinity*, *polarity of atoms*, and all other such terms, whenever they are used to signify the *causes* of the various phenomena attributed to them, to be mere inventions of men who are impatient under ignorance or doubt, and who are at the same time credulous enough to be satisfied with a word, if it be but of their own invention.

POWER OF WIRE GAUZE TO EXTINGUISH FLAME.

The Editor of the *Globe and Traveller* Evening Paper having added to the little article in our last Number, entitled "Masks for Firemen," on copying it into their paper on last Saturday, a paragraph, expressing a doubt as to its utility, we addressed the following letter to him; and as it narrates two very curious and instructive experiments recently exhibited at the Royal Institution, but not yet published in our reports of the lectures there delivered, we think it right to publish them here, in order to show on what grounds our recommendation went. To the readers of The Chemist, perhaps, who bear in mind the experiment we have already given, p. 119, vol. 1st, these illustrations of the principle of small metallic apertures extinguishing flame may not be *necessary*, but they are in themselves amusing experiments, and may be made without trouble, inconvenience, or expense. We prefer giving them now, therefore, to waiting till they are published in their place in the lectures.

"*To the Editor of the Globe and Traveller.*

"Sir,—As you have expressed a doubt as to the power of wire-gauze to cool flame, so as to extinguish it when exposed to the strong heat of a large fire, permit me to

describe two experiments I recently witnessed in the Laboratory of the Royal Institution. It is known, Sir, that the *heat* produced by burning spirit of wine, is much greater than the heat produced by many flames which are much more luminous; and of course, if we can extinguish a flame of this kind with a small piece of wire-gauze, we may extinguish a larger flame, which may be more luminous, but not so intensely heated, by means of a larger surface of gauze. Now, a few weeks ago I saw Mr. Brande place a piece of wire-gauze about six inches square over the flame of a spirit lamp; and though the *flame* played rapidly *on the under side of the gauze*, nothing whatever was to be seen above it; but on bringing a lighted paper to the upper part of the gauze, the vapour which passed extinguished through the gauze was instantly ignited. Thus the gauze completely extinguished the flame, and had the appearance, when the flame was relighted above by the taper, of having cut it in two. On the same occasion, Mr. Brande fixed a piece of camphor, which is a very inflammable matter,* on a piece of wire-gauze, and held the gauze, with the camphor on the upper side, over a lamp, when the camphor smoked and was gradually wasted away, without ever bursting into flame; on reversing the sides of the gauze, and bringing the camphor into contact with the lamp, it instantly burst into flame, but that flame played wholly on the *under surface of the wire-gauze*, and never passed through it. Sir, it was witnessing these experiments which led me to propose, in the little publication I conduct, wire-gauze as a proper substance to make masks for firemen, and as a valuable addition to the means now in use, for the extinction of flame and the putting out of fires. This property of wire-gauze to cool flame, by radiating heat, is quite of modern discovery, and seems not yet to have been put to many of the uses of which it is susceptible. As far as I know, its use is confined to the *safety-lamp*, and the further application of it I recommended seems warranted by the experiments above detailed.

I have the honour to be, Sir,

Your obedient servant,

The Editor of The Chemist.

* It catches fire at a low temperature.

MR. RUTHVEN'S INVENTION DISPUTED.

To the Editor of the Chemist.

Winchester, Nov. 12.

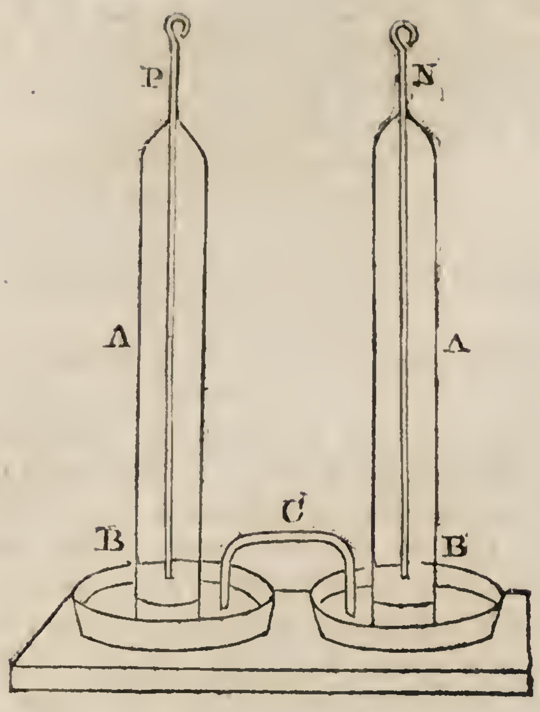
Sir,—I beg to acquaint you that the application by Mr. Ruthven of the excentric wheel as a mechanical power is not new; that the same has been in use in my manufactory these two years, where two such wheels, working in the same nut, move alternately backward and forward a heavy frame by the force of their axles only.

I am, Sir, Yours, respectfully,

W. K. Shenton.

In justice to Mr. Ruthven we now add the following extract from a communication subsequently made by him to the Editor of the *Scotsman*:—

"You will observe that, with regard to the form of the wheel, I claim nothing as original. Wheels of almost every form that can be conceived have long been in use for various purposes; and some I have seen employed in a very ingenious way in power looms. All these applications, however, differ in their use and design from my way of producing power, which is 'by the *axis* of an excentric curved wheel, or whatever form it possesses, *receding* from *the moving power* while *revolving on it*, and being made to revolve by a power applied to the *periphery* of the excentric or curved wheel.' It is a natural inference, that had such a method of procuring power been known, it would have been employed. I have submitted it to several practical engineers, from whose extensive knowledge and observation it could not have escaped, and they at once admitted it to be entirely new. I find, however, the well-known figure of the curve wheel generally misleads till the application is discovered."



INFLUENCE OF ELECTRICITY ON CHEMICAL ACTION.

Take two glass tubes A A, which are closed at top and open at bottom, fill them with an infusion of red cabbage, and then invert them in the basins B B, containing a solution of Glauber's salt, and connected with a glass tube C, also filled with the blue infusion. Let there be two platinum wires P N, each passing nearly to the bottom of one tube, and let P be connected with the positive and N with the negative pole of a Voltaic battery: it will then be found that oxygen is evolved at the wire P, and hydrogen at the wire N. This is derived from the decomposition of the water. At the same time the Glauber's salts will be also decomposed; and the sulphuric acid, which is one of its elements, will pass into the positive vessel, rendering the blue infusion red, while the alkali, the other element, will pass into the negative vessel, making the infusion green. The acid and alkali, therefore, each traverse the tube C, without uniting, in consequence of the electrical influence, while but for that they would immediately combine. These substances are therefore no longer obedient to the usual laws of chemical attraction, and seem only submissive to the more powerful electrical influence.

QUERIES.

The most approved method of compounding liquid and solid blacking without sulphuric acid, which is found to be most pernicious to the leather and the sewing of boots and shoes, and which I presume can add nothing to its colour or lustre?

The best method of refining rape and linseed oils?

RANCID BUTTER.

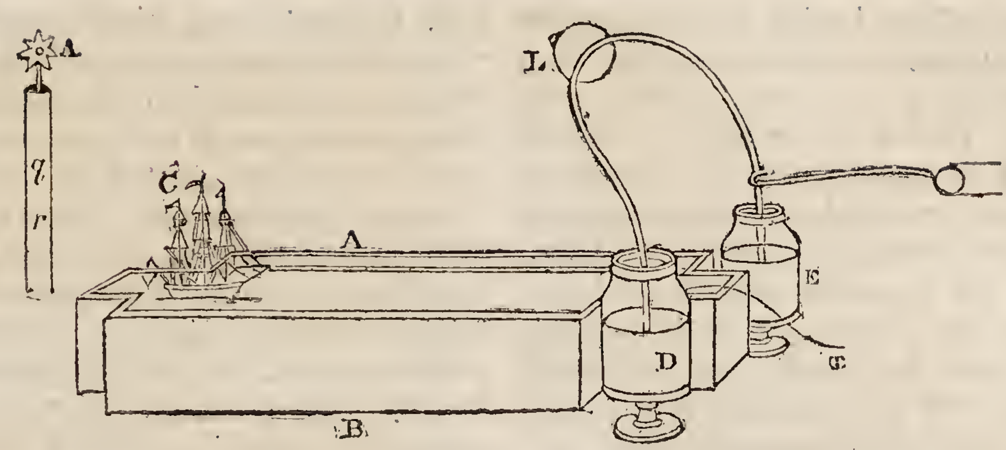
To the Editor of the Chemist.

SIR,—As you desired in a former Number to know a process whereby rancid butter may be deprived of its rancidity, I beg leave to submit the following to your practice, which I find answers better than any other method tried. Put some slaked lime into rain water, and in half an hour pour off a gallon of the clear fluid into a vessel, and to this add a pound or two of the butter; put it over a clear fire, and as soon as it is melted take it off, and allow it to stand near the fire ten minutes. Skim off the melted butter into a large vessel of cold water. Let it then be beaten up with a little salt, (as the whole of the salt is extracted.) By following this process, Sir, I assure you I have made the most rancid butter perfectly sweet and good.

Perhaps, Sir, some of your readers may object to this process, and fancy they will be eating lime with their butter; but they may be assured that the butter served in this way will not contain an atom of that substance; for the acid formed in the butter, whereon its rancidity depends, unites with the lime, and falls to the bottom of the vessel in which the process is conducted. All the white sugar of commerce is purified with lime, and yet does it contain a particle of it? The insertion of this will greatly oblige

Your constant subscriber
and well wisher,
R. T. F.

Forest of Dean, Gloucestershire.



EFFECTS OF LIGHTNING ON SHIPS.

The effect of lightning upon ships may be shown by the following pretty experiment by Mr. Cuthbertson. A B is a trough filled with water; C a ship swimming in it, so that the top of the mast may nearly reach the ball L. Place the ship as in the figure at the end of the trough, and, by means of the thread T attached to it, draw the ship under the ball L, connected with the two charged jars D E, and the charge flying out of L will strike the mast, and break the ship in pieces. When the ship is repaired, unscrew the round piece of brass from the top of the spindle, and hang the chain *q r* upon it, having the star A screwed upon the top. Bring the ship, as formerly, with considerable rapidity under the ball L, and it will be struck by the shock, the fire being seen to pass along the chain, without touching the mast. But if the ship is drawn slowly forward beneath the ball L, no discharge will be heard, as the electricity of the jar is drawn slowly off by the points of the star A.

STEAM GUNS.

We have been somewhat surprised at the pains lately taken to puff Mr. Perkins's steam-gun into notoriety, because at the time when it was first brought before the public, it was stated in several publications that the force of Mr. P.'s steam did not equal half the force of gunpowder. We did intend, therefore, to describe the experiments on which this conclusion was founded; but finding it done to our hands by a Correspondent of the Mechanics' Magazine, we shall take his description of them. The following is the article in that publication :—

"RELATIVE EFFECTS OF STEAM AND GUNPOWDER.

"Sir,—Public attention having been directed to the ingenious steam-gum of Mr. Perkins, a short inquiry into the relative effects of steam and gunpowder may not be unacceptable to some of your readers.

"Before we conclude that a new engine of greater effect has been discovered for the destruction of our species, let us inquire into the nature of that which we possess, and I am satisfied we shall rise from the investigation startled with the prodigious power which we may carry in a goose-quill, rather than convinced that steam, in the state of the greatest elasticity in which we can use it, will ever rival a power which we may pronounce to be stupendous.

"A series of well-conducted and decisive experiments were made by Count Rumford, on the expansive force of fired gunpowder, a detailed account of which, together with engravings of the apparatus employed in so hazardous an undertaking, are to be found in the Philosophical Transactions for 1797: of the facts and the truth of the results, no shadow of doubt can exist, and they, therefore, deserve serious attention.

"In these experiments the Count put the small quantity of twelve grains of gunpowder into an iron chamber, of which the bore was a

quarter of an inch; weights were placed upon a valve closing the orifice; the powder was fired, and it was found to exert a force of 9431 atmospheres. Seventeen grains, when fired in a similar bore, could not raise a weight of 8081lbs. placed on a valve which had an area of the 20th part of a square inch; but 18 grains raised that weight, and thus exerted a force equal to 10,977 atmospheres, or 165,000lbs. on each square inch. In these experiments the powder filled only about half the cavity; hence it expanded to double its bulk, and still exerted this amazing force; but, when the whole cavity, equal only to 1-10th of a square inch, was filled with 26 grains of powder (a quantity insufficient to charge a pocket pistol,) the solid cylinder of hammered iron was burst asunder, though it was in every part one inch and a quarter thick, or five times the bore; to effect which would require a force equal to 54,750 atmospheres, or 410,624lbs. on the square inch. This latter result rests upon a calculation of the force requisite to burst an iron cylinder of the given dimensions. I have examined that calculation, and believe it to be correct; but, whatever doubt may be entertained as to this fact, there can be none with regard to the former—for, in them, the power was estimated by the dead weight which the fired gunpowder actually lifted when placed over an orifice of a given size. In these we find a valve, the surface of which is but the 20th part of a square inch, loaded with nearly four tons, and the elastic force overcomes and lifts it—a fact almost incredible; and, compared with which, the load on the valve of the highest pressure steam generator that ever was invented sinks into absolute insignificance.

"It has been stated that from 700 to 1000lbs. per square inch is the elasticity of the steam used by Mr. Perkins in discharging pistol bullets. These are fired in rapid succession, from a single gun-barrel against a metal target 100 feet distant, and they are completely flattened on it; this, however, is not equal to the effect of a horse pistol, and it is much inferior to that produced by the discharge of a musket. The rapidity of the discharge is, however, to be considered; but, if we reflect that coals, water, pipes, a generator, and furnace, are all requisite to keep up the necessary supply of steam, we shall find that as much bulk and weight are attached to a single gun-barrel as would equal that of a field-piece, which, in my opinion, would discharge more grape, and with infinitely greater force, in a given time, than the whole of Mr. Perkins' apparatus.

"The elastic force, indeed, of steam may be increased by an increased heat, and hence a greater power will be obtained; but, to effect this, there must be a proportionable increase of the size of the generator, pipes, furnace, &c., and this in a much greater degree than is usually supposed even by practical men. It is also to be kept in mind, that there is a limit to the expansibility of steam, which the nature of materials will not allow us to go beyond; and we may presume that no practical use will ever be made of steam beyond one or two thousand pounds on the square inch. Indeed, when we reflect that, at a temperature of 700 degrees Fahr. steam only occupies four times the space of water, whilst, at a temperature of 212 degrees, it expands 18,000 times, we shall discover another difficulty in the fact, that one quarter of the power generated would be required to force the water into the generator, which must be proportionably large to raise so much water to so high a temperature, and keep up that constant stream of it which is absolutely necessary for sustaining a continuous discharge of balls even from so small a bore as that of a gun-barrel. What, then, will we think of an attempt to apply steam to the discharge of ordnance? This, indeed, requires no serious attention; and it is my opinion,

after a careful examination of the subject, that a 24-pounder steam-cannon, equally effective with our common guns of the same calibre, never will be constructed — the thing is manifestly impossible.

"I cannot, however, quit the subject without giving the inventor praise for his ingenuity; for, though it is unlikely to lead to any practical result, it furnishes an instructive and popular illustration both of the effect of steam and the power of the human mind.

A Gun-Sponger.

To this statement we have to add, that steam-guns are not a novelty, and that they have been tried before, and failed. In an article on this subject, lately published in the New Monthly Magazine, there are the following remarks:—" General Chasseloup proposed the employment of steam guns for the defence of places in 1805; and Mr. Watt tried the experiment long before. It is also a fact, that Hornblower, thirty years ago, constructed a steam-rocket, though this is not generally known. General Chasseloup, however, seems only to have had a notion of such a thing, but to have formed no definite plan on the subject. In 1814, M. Gerard, an officer of Engineers, constructed a weapon of this kind. The boiler was moved on a carriage, and supplied steam for six gun barrels, *the breeches* of which *could be opened at pleasure*. On turning a handle, the six barrels received a ball and the steam at once. The longest shots were made by turning the handle slowly, and 180 balls were thrown in a minute. Two cassoons attended the machine, with fuel and bullets. A certain number of these instruments were made for the defence of Paris, but were destroyed on the allies entering that city in the above-mentioned year."

Thus, then, we see that Mr. Perkins' invention has not the merit of novelty; and, what is worse, it has been tried before, and given up because it was found to be only substituting a *less* for a *more* effective instrument. The expansive power of water compared to that of gunpowder is, perhaps, on the whole, greater; but in first of all converting it into steam before it is used, the larger part of that expansive force is destroyed. If a drop of water get within a mould in which metal is to be poured, its expansive power is so great as to scatter the whole mass; but by the application of heat to water in a certain free space, this power is diminished in proportion to the size of this space. Now, first to heat and then to boil water, is a great loss of this power; and, as Mr. Perkins has not compressed steam so as to make it manageable beyond 500 atmospheres, while the explosive force of gunpowder is more than 1000, it is plain that his invention substitutes a less for a greater power. If, however, the *facility of loading* and discharging the piece, which belongs to the steam-gun, and is its distinguishing excellence, could not be imparted to the powder-gun, the steam might be preferable. This, however, does not seem to be an impracticable problem. With the present perfection of our mechanical instruments, and our skill in casting, it seems not impossible to make powder-guns which shall be loaded at the breech. When this is effected, powder will be assuredly superior to steam. Nor does it seem impossible to make a gun which shall be connected with a reservoir both of powder and balls, and by means of a mechanical contrivance to have a certain quantity of this powder and a single ball propelled into the chamber of the gun, and dischared at any given rate. We take no delight in instruments of destruction; but we recommend those who do, rather to turn their attention to the mechanical improvements of which powder-guns may be susceptible than to have recourse to steam. The principle of all improvements must be to load the gun at the breech.

ADULTERATION OF FOOD.

To the Editor of the Chemist.

SIR,—As I presume, from the insertion of his letter, you agree with your Correspondent "A Confiding Man," in the justness of his remarks, I have ventured to offer you a few observations on a production of a similar nature, though, from the celebrity of its author, capable of much more extensive and injurious effects, and which I should imagine your Correspondent has never seen, or he would not have condescended to waste powder and shot upon such an insignificant object as James Maton. The work to which I allude is, "A Treatise on the Adulterations of Food, and Culinary Poisons, by Fredrick Accum."—Book-making is now become an art, and the appearance of a fourth edition of this work is equally a proof of the prevailing taste of the present day, and that the author, amongst his other scientific acquirements, may number a proficiency in book-making. Scarcely a work now issues from the press without a canting and hypocritical preface, abounding with professions of "disinterested motives," "for the public benefit," &c., but the veil is of too flimsy a texture to conceal the real object. Admitting the truth of the statements, (which, as I shall show, is by no means manifest,) I would beg to submit whether the publication of them would not rather tend to increase than diminish the evils complained of; and what benefit the author could expect mankind would receive from the more general diffusion of a knowledge of dangers, which, upon his own admission, are unavoidable. The only effect it can, and has in fact produced, is that of unnecessarily alarming the ignorant and credulous, and creating amongst mankind (God knows, needlessly enough) a greater distrust of each other. Thus, in warning us of poisons which are physically inevitable, he administers a moral poison of much more injurious tendency. As being within the immediate province of The Chemist, you will not, I am sure, refuse your assistance in correcting, as far as is in your power, the mischief which such a publication must infallibly produce: I shall therefore offer to your notice a few remarks on some of the statements, from which the real character of the work may be inferred, and, I trust, its injurious effects in some measure counteracted. A feeling of honest indignation may be allowed to palliate an intemperate warmth of expression, but is no excuse for an obstinate and wilful perversion of one of the best maxims in moral philosophy, which enjoins us to "believe every man honest until we find him a rogue." Our author, like a true modern Diogenes, would evidently inculcate a contrary doctrine, from the exaggerated and highly coloured mode of expression which pervades the whole work, and is apparent in the very commencement: Ex. "Indeed, it would be difficult to mention a *single article* of food which is not to be met with in an adulterated state," and "there are some articles which are *scarcely ever* to be procured genuine." "Spurious articles are *everywhere* to be met with." The following, however, is particularly worthy of notice, as showing into what inconsistencies a too earnest zeal is liable to betray us. In speaking of the various and circuitous channels through which an adulterated article finds its way, he says, (page 10,) "It is such as to *defy the most scrutinizing endeavours to trace it to its source*;" and (in page 44,) "The ingenuity and perseverence of self-interest is proof against prohibitions, and contrives to elude the vigilance *of the most active government*;" and yet, in the face of these assertions, he says, (page 12,) "It is really astonishing that the penal law is not more effectually enforced against practices so inimical to public welfare." And again, in the same sentence, we find, "The man who robs a fellow-subject on the highway is sentenced to death, whilst he who distributes a slow poison to a whole community *escapes un-*

punished;" although immediately afterwards we find whole pages, containing the convictions of bakers, druggists, brewers, grocers, publicans, &c. and in every case punishment inflicted!! The author must reconcile these inconsistencies as he can. The conclusion of the preliminary remarks offers us the very climax of consolation:—"Thus devoted to disease by baker, brewer, grocer, wine-merchant, &c. the physician is called in to our assistance; but here, again, as I shall presently state, the pernicious system of fraud, as it has given the blow, steps in to defeat the remedy." This is intended as an introduction to the first class who are honoured by Mr. Accum's notice, the chemists and druggists, and, as usual, the whole are included, without distinction, in one sweeping and libellous censure. From the author's celebrity as a chemist, we might naturally have anticipated some useful instructions to detect the iniquity of these gentlemen. From the whole Pharmacopœia, however, he has only thought proper to select a few articles of minor importance, to which he says no tests can be applied; and for calomel, magnesia, and spirit of hartshorn, he has given such as will not much increase his reputation as a chemist: Ex. "The genuineness of calomel may be ascertained by boiling, for a few minutes, one part with 1-32d part of muriate of ammonia in ten parts of distilled water. When carbonate of potash is added to the filtered solution, no precipitation will ensue if the calomel be pure." It will be evident to any person at all conversant with the subject, that this test would only detect chloride of mercury, (sublimate,) the presence of which could only arise from the carelessness of the manufacturer, in not sufficiently washing it; any one base enough to sophisticate a medicine of such importance, would take care to employ an insoluble substance, in which case the test would be entirely useless. Mr. Accum should have added, that after the application of the carbonate of potash to the liquor, the calomel, if pure, would be totally volatilized by heat. Whether the omission arose from ignorance or carelessness, it is equally culpable; for with the authority of his name, it must tend greatly to mislead those to whom more particularly it is addressed, and whose deficiency in chemical knowledge is unfortunately already too notorious. I should wish to notice numerous other errors and absurdities which occur throughout the whole work, but am afraid to exceed the limits generally allowed to your Correspondents; with your permission, I shall make them the subject of another letter, and conclude this with one extract, which I think can only be characterized as a gross libel on humanity, with a blasphemously misapplied quotation:—"When lucre becomes the reigning principle, *the possible sacrifice of a fellow-creature's life is a secondary consideration.* In reference to the deterioration of almost all the necessaries and comforts of existence, it may be justly observed, in a civil as well as a religious sense, that 'in the midst of life we are in death.'"

Your friend,

OBSERVATOR.

* We shall be glad to hear again from our Correspondent.

NEW VOLTAIC-MECHANIC POWER.

(FURTHER DEVELOPMENTS.)

THAT the powerful agent, Voltaic electricity, is speedily destined to pass from the laboratory to the workshop, is not disputed by any person with whom we have conversed, or from whom we have heard on the subject. It is admitted to be applicable as a mechanic power, but the suggestion is so novel, that no experiments have yet been instituted to ascertain its advantages. All the mighty effects in nature of what is called electricity, are not known to us; but that it is the active agent in most of the changes of the atmosphere, and in producing many other important phenomena, is clearly established; and

by borrowing it, therefore, we may expect in time almost to equal, by our labours, some of the minor but stupendous works of nature. It was an observation of that illustrious man, Lord Chancellor Bacon, "That man can only subdue nature by obeying her laws;" and in the same manner we may say, that man can only hope to equal her operations by working with her instruments. The connexion betwixt common electricity and *Voltaic* electricity is clearly shown in the lecture reported in our present Number; and the connexion between, or rather the identity of, common electricity and lightning has been long known and admitted. Thus we have, in the Voltaic battery, manifested indeed by some unexplained causes, but manifested in such a manner as to be perfectly at our command, the same agent which hurls lightning through the sky, and which is so terrific, that, till science explained its origin, it was considered as an indication of the ire of an avenging deity. It is this agent which we stated in our last Number, might be introduced into use as a mechanic moving power, and of which we then promised some further developments.

The objections stated to our proposal amount in substance to two. The first is, that the expense of generating a sufficiency of the two gases will be so great in proportion to the quantity obtained, that it can never be so economic a power as steam. The value of this objection amounts to this: coals are now comparatively cheap in England, and copper, zinc and sulphuric acid comparatively dear. But there are countries and situations in which fuel is scarce and dear; and in such it may be advisable to think at least of a Voltaic-mechanic engine. But those who make this objection are quite in the dark as to the quantity of the gases generated by a Voltaic battery; no experiments, in fact, have ever been made to ascertain what quantity of gases are produced with a given Voltaic battery within a given time. This is a point we mean to ascertain, but have not yet been able. We may observe, however, that the quantity we may produce will always depend on the size of the instrument, and extent of the metallic surface exposed to the action of the acid; and if we choose to add to the number and size of the plates, we may decompose an indefinite quantity of water.

The expense of a Voltaic battery, according to the charges of the philosophical and mathematical instrument makers about town, is, for each trough complete, containing 10 pair of plates, of four inches square, the size of those at the Royal Institution, on Dr. Wollaston's plan, 2*l*. 4*s*.; making the expense of a battery of 400 pair of plates, 88*l*. By the ordinary method of connecting the plates, such a formidable battery will cost, for each trough of 10 pair, 1*l*. 14*s*.; making, for the whole, 68*l*. With the ordinary wear of such a battery, it is calculated that it will last two years. Let us suppose that ours will be more frequently in action, and will last one year; then, the capital required for such a battery will be only 88*l*. per year. The troughs, also, do not wear out like the metals, and therefore want no renewing. They cost 10*s*. each. The acid employed costs about 3*d*. per lb. buying it from the dealers in London. The proportion recommended by Mr. Brande is 1 lb. of acid to 60 lbs. of water; and supposing it takes 20 lbs. of this liquid for each trough, (consequently one-third of a lb. of acid,) and that the acid requires to be renewed once every day, we shall have for the daily expense of the acid, 3*s*. 4*d*. The labour of managing this part of the business will be a mere trifle; and as the mode of operating will produce almost a perfect vacuum, we say, that for the daily expense of 3*s*. 4*d*. and a capital advanced of somewhat less than 100*l*., we may get a very considerable power: the cost of its application is another thing, and must be decided by other principles.

In this estimate of the expense of

a Voltaic battery, it must be recollected that we have taken the price which philosophical instrument makers, who are men of talent and ingenuity, and are paid accordingly, charge for these things; and that the article they supply is finished with great neatness and care. For Voltaic batteries to produce a mechanic power, we should go the cheapest and most economical way possible to work. Taking this into consideration, we have no hesitation in saying, that whenever Voltaic batteries should be articles of regular manufacture, and there were a considerable demand for them, that their price would be reduced more than one half. In our opinion, it is a considerable recommendation of the Voltaic mechanic power, that all the materials which go to produce it, are, in a great measure, the product of labour, and will get cheap as that labour is more efficient. Another thing also, which requires to be observed, is, that the copper and zinc, and the acid employed, would not be annihilated, and might be recovered; consequently, the expense of supplying these articles would be little more than the expense necessary to recover them after being used. We have, in fact, decomposition and recomposition, both of the water from which we procure the gases, and of the materials by which we decompose that water; and the power we actually employ, or consume, is only that immaterial agent, which is made manifest on the decomposition and recomposition, and which, as it is measureless, is inexhaustible.

Even if it should turn out that galvanic electricity, employed to decompose water, and inflame the gases, is an expensive way of getting power where fuel is cheap, a point however which is not ascertained, for nobody has made any experiments concerning it, the suggestion may still be of great utility where fuel is dear, or where it cannot be procured. Even where it is cheap, a Voltaic mechanic power may still have some recommendations. The space into which it may be put is small; it emits no smell, and sends forth no smoke; it will annoy nobody, and never be a nuisance; it does not depend for its operations on the elements; the materials necessary for it are all easy of carriage; and it may thus perhaps serve to equalize the gifts of nature, and liberate industry and the arts from the fetters of local restriction.

The other objection which applies to working explosive engines, which a Voltaic-mechanic engine will be, shall be considered in our next.

DICTIONARY OF CHEMISTRY.

Cruor, *crassamentum, clot.* The coagulable part of the blood.

Crucibles. Pots made either of earth, black-lead, forged iron, or platinum, and used for roasting, calcining, or fusing substances.

Crusts. The bony coverings of some fish, as crabs, lobsters, and of some insects and reptiles. They consist, in general, of a cartilaginous substance, like coagulated albumen, carbonate of lime, and phosphate of lime. They are distinguished from bones by possessing a greater quantity of the second ingredient, and from shells by a greater quantity of the third.

Cryolite. A very curious and rare mineral, found only in West Greenland. It is a soda-fluate of alumina, and consists of alumina 26.33, soda 32.51, fluoric acid 22.63, water 18.53.

Cryophorus, *the frost bearer, the carrier of cold.* An instrument invented by Dr. Wollaston to show the relation between evaporation at low temperatures and the production of cold.

Crystals. A variety of substances, in passing from a fluid to a solid state, and many which we know only as solids, assume particular forms, which are found to be always the same in the same substances; so much so, that any difference in the shape of the crystals, or even in the angles of these crystals, is looked on as a proof that they are different substances. Most mineral solids are crystallized, and a very celebrated sys-

tem of Mineralogy, which means only classifying and naming the stony substances of the earth, has been founded on the diversity of the shape of crystals.

CRYSTALLIZATION is the assumption by bodies of the crystalline form. To produce it, the substances must be either fused or melted, and then, when left at liberty, they arrange themselves, on again becoming solid, in certain forms, peculiar to each substance. It is a process much used in the arts to purify substances, and in chemistry. A great variety of theories have been published to explain the reasons why bodies assume certain forms and no others, and some of these theories having been already reported in The Chemist, No. XXXII., we shall not enter further on the subject.

CUBE ORE. An arseniate of iron, found in Cornwall and in France. Its constituents are said to be 31 arsenic acid, 45.5 oxide of iron, 9 oxide of copper, 4 silica, and 10.5 water.

CUDBEAR. The name of a preparation of *archil*, manufactured at Glasgow, and used as a dye.

CUPEL. A shallow earthen vessel, used in assaying.

CUPELLATION. Refining gold by scorification by lead, in which the *cupel* is used.

CURD. The coagulated substance which separates from milk on an acid being added to it. Some other substances have the same effect, as an acid.

CUTIS, *true skin*. One of the layers into which anatomists divide the skin; the other is the *epidermis*. Anatomically, it is a thick, dense membrane, composed of fibres, interwoven like the texture of a hat; chemically, a particular modification of gelatine.

CYANITE, *kyanite*, *disthene*. An inferior sort of sapphire, found in Scotland and in India. It consists of 45 silica, 55.5 alumina, 0.50 iron, and a trace of potash.

CYANOGEN, *prussine*. The base of prussic acid: it is a gas, consisting of two volumes of vapour of carbon and one of nitrogen.

CYMOPHANE, *chrysoberl*.

CYSTIC OXIDE. An ingredient discovered by Dr. Wollaston in a species of urinary calculi.

TO CORRESPONDENTS.

W. W. Wolverhampton, will probably find what he wishes to know, in p. 318, Vol. I. No. 20, of The Chemist.

We hope we shall be able to supply the information required by 'Borax;' though we must observe, that it is not necessary for two countries to be under the *same government* to enjoy a mutual trade to the utmost extent of the advantages possessed by each. We always give preference to those commodities which suit best, both as to price and conveniency, without ever inquiring *where* they were produced.

"A Would be Chemist" is assured, that we have never before heard it denied that Black and White are colours; we have heard disputes as to *where* these colours exist, but never heard their existence denied. We suppose our Correspondent must have been present at some dispute as to whether colours were mere sensations or states of our minds, or whether they inhere and exist in the bodies outside of ourselves. The former is the opinion of all philosophers, and the latter the opinion only of those who have never thought on the subject.

T. C. and B. G. are informed, that the Chemistry of Tanning will shortly appear in our pages.

To several Correspondents who have made inquiries of us respecting Mr. Brown's pneumatic engine, we have to reply, that we have never seen any statement of its expense, and of its economical advantages. We have heard, however, on what we conceive good authority, that a bushel of coals, applied to produce power by steam, generates five times as much power as a bushel of coals applied on the principles recommended by Mr. Brown. If this assertion is an error, we hope that gentleman will enable us to correct it, by stating what quantity of power his engine does actually produce in proportion to the fuel consumed.

Mr. Vallance and Philo Chemicus have been received.

*** Communications (post paid) to be addressed to the Editor at the Publishers'.

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The Chemist.

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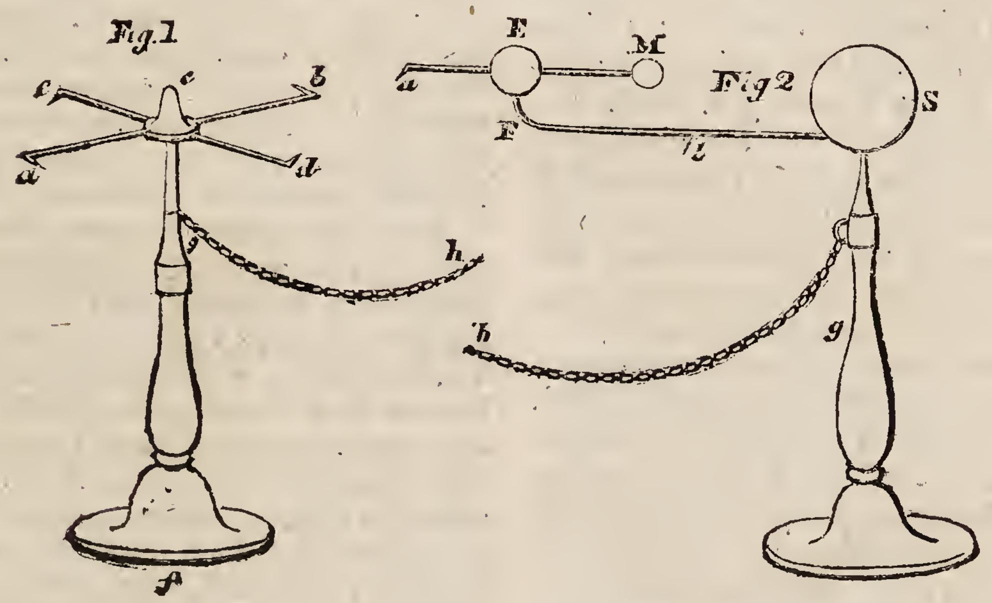

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ELECTRICAL SUN.—ELECTRICAL ORRERY.

The first Figure represents a means of forming a beautiful circle of light by help of an electrical machine. If two cross wires, *ab*, *cd*, with a cap *e* at the point of intersection, and having four sharp points, as *a*, *b*, *c*, *d*, turned in the same direction, be nicely balanced upon a point at the top of the insulated rod or stand *e f*, and if they are connected with an electrified conductor by the chain *g h*, they will immediately receive a rotatory motion. In the dark, a stream of light will issue from each point, and, from the velocity of rotation, these four streams will form a beautiful circle of light.

On the same principle, an apparatus called the electrical orrery is constructed. If a globe S, our second figure, representing the sun, has a projecting arm S b F, and if upon the pointed extremity of this arm is balanced another ball E, representing the earth, carrying a wire M a, with a point a at one end, and at the other a ball representing the moon; then, if a point b is fixed in the middle of the arm S F, and if the whole is balanced on an insulated stand, by loading one side of the globe S, let the apparatus be connected by a chain g h, with the prime conductor of an electrical machine, and a rotatory motion will be given to both the arms, so that the moon M will move round the earth E, while the earth performs its revolution round the sun S.

LONDON CHEMICAL SOCIETY.

On Thursday, November 25th, this Society, which is placed under the auspices of Dr. Birkbeck, had a Public Meeting at the City of London Tavern, for the inauguration of its Officers. At least 300 persons were assembled on the occasion, and amongst them were a great many ladies. The business of the evening was opened by Mr. Marrecco informing the company, that the Secretary would, with their permission, read the Report of the Committee. Mr. Jones, the Secretary, then read the Report, of which the Committee have favoured us with a copy. Adverting first to the origin of the Society, it said—

Gentlemen,—In June last a letter appeared in a periodical Paper, entitled The Chemist, proposing the establishment of a Chemical Society; several letters were written to the Editor of that Journal, which he, with a laudable zeal for the furtherance of science, caused to be inserted.

In consequence of the numerous applications made to the Editor, a meeting was convened for the 20th June, at 55, Great Prescott-street, which was adjourned till 15th July, when a Committee was appointed, consisting of Mr. Marrecco, Mr. Fenner, Mr. Austin, and Mr. W. Jones, to prepare the Rules and Regulations of the Society. Your Committee having elected Mr. Marrecco Chairman, and Mr. W. Jones as Secretary, assembled several times for the purpose of framing the "Statutes of the Society," and finally called a General Meeting on 12th August, when Mr. Marrecco being called to the chair, the Rules and Regulations, previously prepared by the Committee, were read, and unanimously passed into laws. A series of Resolutions were also passed, empowering your Committee to print the Statutes of the Society, and distribute them, and vesting in the Committee the powers of the Council. Thanks of the Society were also voted to Mr. Mongredien, the Editor of The Chemist, Mr. W. Jones the Secretary, the Committee, and the Chairman, for his able conduct in the chair.

Your Committee having also been empowered to select some scientific gentleman to whom they might offer the Presidency, made application to Dr. Birkbeck, a gentleman too well known in the scientific world to need any encomium from your Committee; when he, with his usual zeal for the diffusion of knowledge, was pleased to accept the same, although the Society was in its infancy, and consisted of but a small number of individuals; and your Committee need not state of how much utility his name has been to the Society.

Your Committee having hired, *pro tempore*, a room at No. 18, Aldermanbury, Lectures, by Mr. Austin, one of your Committee, and Mr. Partington, of the London Institution, were there delivered until the 26th Oct. On 18th November, a General Meeting was held, when the following gentlemen were elected as Officers and Council for the ensuing year:

President.
Dr. Birkbeck.

Vice-Presidents.
J. F. Cooper, Esq.
A. J. F. Marrecco, Esq.

Treasurer.
G. Smith, Esq.

Secretary.
Mr. W. Jones.

Curator.
Mr. J. B. Austin.

Members of the Council.
Mr. H. Fenner,
— T. Dell,
— W. S. Stratford,
— H. J. Silva,
— C. Dunderdale.

Your Committee, in the very short time the Society has been established, have received communications, accompanied by donations of books, from various authors of eminence. From the prosperous state of the Society, and the great increase latterly of its members, they sincerely hope that the Council, at the next Annual Meeting, will have communications to lay before it worthy the Society.

Your Committee refrain from entering into the future views and objects of the Society, the President having undertaken to explain previous to delivering his Lecture.

The Report concluded by the Committee returning their thanks to the Society for its indulgence, and expressed their hopes, that under the auspices of so scientific and zealous a President, each successive year would witness the utility as well as the prosperity of the *London Chemical Society*.

Dr. Birkbeck then delivered the following *

INAUGURAL LECTURE.

Of the world which we inhabit—of the vast and magnificent planetary system to which we belong—of the still more stupendous arrangements, which, at distances immeasurable, we are permitted to contemplate—the most impressive characteristic is change. The universe may therefore be regarded as one mighty system of changes. The great masses—the atoms which compose them—whatever is destitute of organization—whatever is organized—beings which vegetate, which live and which decay—all are subject to, and exhibit unceasing variety. What appears to be rest, is continued motion. There is not a particle of the planet on which we dwell, that continues in the same point of space, during the instant in which we strive most rapidly to think of it. Life and death, as far as the same mass is concerned, are dissolution alike; or, rather, in the same space of time, there is a more varied decomposition amongst the living than the dead.

Throughout this scene of perpetual fluctuation, it is impossible not to remark two distinct series of events: the phenomena belonging to masses being distinguishable motions, whilst those occurring amongst the atoms themselves, although unquestionably accompanied by some change of place, do not exhibit the slightest measurable motion. Amongst

Planets, suns, and adamantine spheres,
Wheeling unshaken through the void immense,

change of place is distinctly recognised; not less than in the minuter portions of this earth, when impelled by powers of various descriptions. Nay, in numerous instances, change of place is the whole phenomenon: but change of property, and change of configuration, are unceasingly occurring around us, in every part of the three great kingdoms of nature—the animal, the vegetable, and the mineral. Yet the intermediate steps, the internal motions inseparable from the result, remain, even by the most scrutinizing, for ever unperceived.

A complete history of nature will consequently be composed of a description of simple existences, and of the phenomena which are accompanied by motion, sensible or insensible. The first it is the province of the natural historian to furnish, whilst the others belong to the natural philosopher. Of the phenomena themselves, the first assemblage has been designated by the term natural philosophy, or of late, more correctly, by the title of mechanical philosophy; whilst to the second, the terms physiology and *chemistry* have been applied. Physiology exclusively comprehending the functional phenomena of living organized beings, the object of chemistry will appear to be, to discover and explain the changes that occur amongst the integrant and constituent particles of different bodies; and the ends of this branch of knowledge, I may briefly observe, are the application of natural substances to new uses, for increasing the comforts and enjoyments of man, and the demonstration of the order, harmony, and intelligent design of the system of the earth.

For the successful attainment of these great objects and ends, accommodations of a peculiar and extensive description are indispensable; such, indeed, as it falls to the lot of very few individuals to command and to enjoy. Hence the necessity for co-operation; hence the unquestionable importance of associations, uniting minds of congenial tendencies, which, with equal ardour, but with various powers, are directed to the promotion of one great and universal good, the enlargement of the dominion of science: and hence the probable, may I not be allowed to maintain the *certain* advantages which will accrue from the foundation of the

LONDON CHEMICAL SOCIETY—a Society, originating at a period most favourable to the cultivation of natural knowledge, and under circumstances the most flattering and auspicious; for such I am entitled to consider the aspect of this large and enlightened assembly,

* We have to return our thanks to Dr. Birkbeck for the great readiness with which he gave us a copy of his discourse.

collected to witness, and by scientific sympathy to animate, the proceedings of its inauguration.

Further to insist upon the fitness and necessity of these measures in special reference to Chemistry, must, upon the present occasion, I feel, be pronounced superfluous. I cannot, however, deny myself the pleasure of introducing to your notice a confirmation, from an elegant and eloquent preface, written by the justly celebrated Keir, the intimate friend and companion of some of the master-spirits of the age. "The study of Chemistry ought not (says he) to be confined to *learned* men. It regards the arts and the things of common utility to mankind. Besides, the only means by which a science like this, which depends on multiplied observation and labour, can be cultivated with great success, is to infuse a general taste and knowledge of it, and *thereby to engage numbers in its pursuit*. Let us remember, that it is the glory, and the characteristic of the present age, that knowledge has been more diffused than in any former period; and let our efforts be still directed to extend, and not to narrow, these benefits to mankind."

It may not be out of place here to state, that chemistry is not only not intended to be confined to *learned* men but not even to *men* exclusively. Hitherto, ladies have conferred the honour of their presence upon all our public proceedings; and we are exceedingly desirous, although it is not consistent with the present constitution of the Society, that they should hereafter become participators also, as members. That they are well qualified for pursuing this branch of science, I may adduce, as evidence, the very able Essay, by Mrs. Fulhame, "On Combustion"—a subject, I may incidentally observe, peculiarly appropriate to the female sex, since their fame as *incendiaries* has not expired with the conflagration of Troy. In further evidence, I may adduce the "Conversations on Chemistry," by Mrs. Marcet; which, as an interesting and instructive elementary work for the uninitiated, has never yet been equalled. And, lastly, for examples need not now be multiplied, I may notice the elegant "Conversations on Mineralogy," by Miss Lowry, assisted, it is true, by her father, the late ingenious artist; the beauty and effect of whose engravings of mechanical and chemical apparatus remain still unrivalled.

The concise exhibition of the objects and powers belonging to, and productive of the operations of chemistry, and of its varied and important applications, which I shall next place before you, ought, some may apprehend, to be introduced by a brief report of its origin, whether viewed as an art or a science. The records of past ages, upon this occasion, as well as upon many others, furnish us with very little information that is satisfactory. Indeed, it will in vain be expected that we should trace with accuracy the various steps by which the human intellect has advanced in the cultivation of any of the arts and sciences, or that we should ascertain with precision the period at which any of them was first introduced into the world. In vain, for instance, shall we inquire who invented the first plough, baked the first bread, shaped the first earthen vessel, wove the first garment, or hollowed out the first canoe. In vain shall we inquire who first marked those natural occurrences, those germs of science, which during the lapse of ages, have expanded into the most glorious ornaments of intellectual man; "for," (to adopt the language of an introductory address, lately delivered in the Glasgow Mechanics' Institution, which I shall be excused if I designate as one of the most important modern auxiliaries to the diffusion, if not the advancement, of knowledge,) "he is to be regarded as the founder of astronomy, who, amidst his flocks on the plains of India or Chaldæa, first discovered the erratic motions of the planets; and he is to be regarded as having made the first steps in mineralogy who returned from the mountains with some beautiful crystal, to adorn the rude cave that sheltered him. He, also, was the first zoologist, who in the chace, first learned to distinguish the various habits and manners of the forest families; and *she* was the first botanist, whose gentler spirit first took delight in the cultivation of flowers." And, pursuing this principle, I may add, he was the first chemist who first marked the gathering cloud which obscured the splendour of the primeval sky, or who first noticed the soft dews as they descended to refresh the earth from which they had recently exhaled.

Whilst chemistry continued in its early state of insignificance, some importance might be derived from its apparent or reputed antiquity. It was, then, with no small degree of exultation, traced back to Tubal Cain, an antediluvian worker of metals; or was discovered in the act of fermentation, practised to his own disgrace by Noah, soon after his signal preservation from the most awful catastrophe to which this globe, since it emerged from chaos, has ever been exposed; or was detected, at a much later period, in the operation by which Moses was enabled to punish his besotted followers, by making them swallow the golden calf, prepared as the object of their adoration. From all pretensions to science, these occurrences must be excluded, not less than those facts which have been advanced to fix its origin in the fifth or sixth century of the present era. Nor

can the praise of originating our science, be awarded to the mysterious labours of the alchymists in the transmutation of metals and the preparation of the elixir of life, which were continued with ardour unparalleled through the whole of the middle ages. During this astonishing combination of knavery, superstition, and ignorance, practical chemistry might be said to have flourished, for one of the mystics, in his search after the powder of projection, by means of which the baser metals were to be converted into gold, performed the following processes:—"Fusion, calcination, vitrification, separation, cribration, ablution, edulcoration, despumation, limation, pulverization, granulation, putrefaction, maceration, fumigation, cohobation, precipitation, distillation, rectification, sublimation, rapidification, extinction, reverberation, fulmination, extraction, digestion, circulation, consolidation, and amalgamation." Yet, after all this, the coy and obdurate metal refused to appear. At the close of one process, however, a substance almost as valuable as gold glowed in his furnace, the highly esteemed *Dresden China*, the importance of which, in a commercial point of view, was so evident to the Elector of Saxony, that he bestowed on the inventor a large estate, and raised him to the rank of nobility.

The first gleam of real science which the history of chemistry discovers to our search, irradiated from the mind of the celebrated Beecher, whose work, entitled *Physica Subterranea*, was published in the year 1669. His system was unfolded and expanded by Stahl, his able follower, and many others; yet still we see but a small portion of science in all the productions which preceded the philosophical career of the illustrious but ill-fated Lavoisier, who fell a victim, as the cultivators of chemistry still remember with keen regret, to revolutionary fury. Towards his great, and, in a high degree, successful efforts, the experimental labours of Black, of Scheele, of Bergman, of Cavendish, and of Priestley, were essentially instrumental. Of Scheele in particular, "whose genius," as observed by Dr. Thomson, one of our ablest systematic writers, "though unassisted by education or wealth, burst forth with astonishing lustre, and who, at an age when most philosophers are only rising into notice, had finished a career of discoveries which have no parallel in the annals of chemistry. Whoever wishes to behold ingenuity combined with simplicity—whoever wishes to see the inexhaustible resources of chemical analysis—whoever wishes for a model in chemical researches, has only to peruse and to study the works of Scheele." Of Dr. Priestley, likewise, in particular, (who was driven from this land by the misdirected zeal of his countrymen,) we may speak as one of the earliest auxiliaries to Lavoisier. His well-merited eulogium, pronounced by one of the most eloquent living theologians, I feel it to be an act of justice due to his memory, now to repeat:—"His enlightened and active mind, his unwearied assiduity, the extent of his researches, the light he has poured into almost every department of science, will be the admiration of that period, when the greater part of those who have favoured and those who have opposed him will be alike forgotten. Distinguished merit will ever rise superior to opposition, and even derive lustre from reproach. The vapours which gather round the rising sun, and follow it in its course, seldom fail at the close of it to form a magnificent theatre for its reception, and to invest with variegated tints and with a softened effulgence, the luminary which they cannot hide.

The last great epoch which in this exceedingly abridged history of our science requires to be noticed, commences with the Voltaic researches of our illustrious countryman, Sir Humphry Davy. Provided with a new and almost irresistible analytic power, and blessed with a spirit of investigation inexhaustible in the suggestions of analogy and the creation of experimental resources, he achieved discoveries which some have pronounced to surpass in importance, as they certainly do in splendour, the united discoveries of preceding chemists. "When we survey," says one of his ardent admirers, "the Transactions of the Royal Society for the years 1808, 1809, 1810, and 1811, we are overwhelmed with astonishment at the unparalleled skill, labour, and sagacity by which the great English chemist, in a space so short, multiplied prodigiously the objects and resources of the science, while he promulgated a new code of laws, flowing from views of elementary action, equally profound, original, and sublime." How much he felt himself indebted to the discovery of Volta, Sir Humphry has, with striking candour, confessed, in the following words: "Nothing tends to the advancement of knowledge so much as the application of a new instrument. The active intellectual powers of men in different times, are not so much the causes of the different success of their labours, as the peculiar nature of the means and artificial resources in their possession." After all, however, the application of his knowledge to the preservation and amelioration of human existence, some instances of which will soon be brought before you, constitute the most imperishable elements of his glory; and will for ever throw around his memory the brilliant halo of scientific philanthropy.

The great energies or powers by which the varied phenomena of the material

world are produced, may be arranged under the comprehensive terms, Attraction and Repulsion—words difficult to define, and the occasion of much discussion, but which conveniently denote tendencies, without reference to causes.

[Dr. Birkbeck then proceeded to explain the different forms of attraction and repulsion; and of the leading principles of chemistry, of which he gave numerous illustrations; and we have to regret that our space will not permit us to follow him through this part of his discourse. We shall only observe, that the illustrations were both beautiful and well adapted, as well as numerous, and were received with delight by a crowded audience. After concluding his account of the great principles of chemistry, the learned Doctor proceeded to speak of their application to the business of life.]

To enter (he said) into a full detail of the applications of Chemistry, would, at this period of the evening, be unwarrantable, for it must include the whole range of science. In every branch of natural history, it is of primary importance; but especially in mineralogy, which is now founded upon a beautiful and methodical classification, chiefly in consequence of a comparison of the intimate composition of the bodies it describes, with their obvious forms and appearances. By the assistance which it affords in explaining the growth and nourishment of organized beings, chemistry throws considerable light on botany and zoology; and by the illustrations which it furnishes of the composition of animal structures, and of the agents which injure, destroy, or rectify them, it adds greatly to the perfection and the power of physiology and medicine. By developing the operations of caloric, chemistry enables us to understand many of the phenomena presented by the atmosphere, such as the formation of clouds, rain, hail, snow, and meteors; and it even extends its aid to promote the most sublime of all the sciences—astronomy; for, by improving the materials used in conducting observations, the philosopher has obtained means of tracing, with more accuracy, the revolutions of the planets, and of penetrating still farther into the remote regions of space, to discover the forms, appearance, and arrangement of the distant portions of the universe.

It is, however, from a connexion with most of the processes and operations of common life, that chemistry derives its most obvious claims to our admiration, applying, as it certainly does, advantageously to those processes on which we depend for the gratification of our wants; and which, in consequence of their extension by the advancement of science, have become the sources of the most refined enjoyments and delicate pleasures of civilized society. I shall not be required to insist upon the services rendered by chemistry to the bleacher, the dyer, and the worker of metals; in tanning, and the preparation of leather; and in the production of porcelain, glass, and gems, its services are unquestionable; every one of these processes, it is generally known, has been assisted, and some in a very great degree, by chemistry.

How intimate is the connexion between the art of agriculture—one of the arts most useful and indispensable to man—and the science of chemistry, the admirable lectures on agricultural chemistry, delivered by the President of the Royal Society, very strikingly demonstrate. In that work it is ably and clearly shown, that although many parts of the surface of the earth will produce vegetable food, and some even without the aid of man, yet to produce it in the greatest quantity, and of the best quality, recourse must be had to the methods of cultivation, dependant upon scientific principles. The benefit of this connexion, it may be observed, extends also to the cultivators themselves, as well as to the soil. "Since, indeed," says Sir Humphrey Davy, "this truth has been understood, and since the importance of agriculture has been generally felt, the character of the agriculturist has become more dignified and more refined. No longer a mere machine of labour, he has learned to think and to reason. He is aware of his importance to his fellow-men, and he is become at once the friend of nature and of society." That much yet remains to be done for this art, it is scarcely necessary to observe, for until every field shall become a garden, it is clear that agriculture has not attained its acme. That this is no ideal point of improvement we must admit, when we advert to the state of this art amongst the Chinese, and to the manner, in which they are at once compelled and enabled to practise it, by an overflowing population. To accomplish this in a less favourable clime, and with less manual labour, as the Rev. Dr. Cartwright has well remarked, "the combined energies of various arts must be employed; Chemistry must lend her inexhaustible stores, Mechanics her hundred arms. The one by calling into action the latent processes of nature, gives to vegetation renewed life and increasing fertility; the other, by furnishing man with multiplied ability, gives to a pigmy the powers of a giant."

[As illustrations of the refined application of chemical science to the purposes and conveniencies of life, Dr. Birkbeck here introduced to the notice of his auditory Mr. Gordon's portable gas lamp, Sir Humphrey Davy's safety lamp, and his mode of protecting copper sheathing. He explained the principles of all three,

and exhibited models of them. Throwing about the portable lamp, he showed that it might be subjected even to violent motion, and neither oil nor tallow soil the floor, or a lady's fingers. The effect of the wire gauze in extinguishing flame, he showed among other means by placing one of the safety lamps over the burning stream of carburetted hydrogen, which did not pass through the wire; afterwards he applied a taper over the lamp, and the gas again caught fire, while the centre of the lamp showed no light whatever. He exhibited also a model of a boat, the copper of which was defended on Sir Humphry Davy's principles; and which is, perhaps, the first application of the voltaic power to the ordinary uses of life. After explaining these curious discoveries, and applications of chemical principles, he proceeded to say,]

The safety lamp — the result of the exercise of an extraordinary power of perceiving and pursuing the light of analogy—consists as you have just seen, of an arrangement the most simple, scientific and efficient. Protected by it, the miner, during his subterraneous excursions, in quest of coal—the most valuable mineral treasure—proceeds without the occurrence, and even without the apprehension, of those tremendous explosions, by which multitudes have been annually mutilated and destroyed. Had the future fame of this illustrious friend to science been dependant on this invention alone, resting, as it assuredly does, on the firm basis of public good, and the extensive preservation of human life, grateful posterity, ages yet unborn, must encircle his name with

> Those never-fading wreaths, compared with which
> The laurels that a Cæsar reaps are weeds.

That I may not longer detain you, and I fear that I have already inconveniently trespassed upon your patience and attention, I shall merely add, that the founders of the Chemical Society, hope as they proceed, to exercise some influence upon the progress of science, by promulgating its truths, and furnishing the means of prosecuting trains of experiments, which may have been performed by others, or those which may arise from, or conduct to, original views, in their particular department. They are fully apprised of the difficulties incident to experimental research, and of the very small number of inquirers who will submit to its drudgery, or who can successfully contend with its perplexities; yet they entertain a somewhat sanguine hope, that by their efforts, the force of the following observations, lately made by the celebrated Professor Leslie, may be abated: "the public are not aware," says he, "how few original experimenters exist; men of science are generally satisfied with talking about the discoveries or speculations of others; they are often unable, or unwilling to defray the expense of procuring new instruments; they want sufficient leisure to apply them; and they are averse to submit to the training necessary for acquiring habits of expertness."

The age in which we live is unquestionably distinguished beyond all preceding periods, by the sudden and extensive impulse which the human mind has received. To the profound instructions of Lord Bacon, by which we have been led to interrogate nature by the aid of experiment; and to the magnificent example of the immortal Newton, displayed in his wonderful career of philosophical discovery, this great distinction is principally to be ascribed. The march of his gigantic intellect, which indeed must be the march of every intellect that attains to scientific eminence, and therefore cannot be too generally known, has been thus eloquently depicted by the celebrated Dr. Chalmers: — "It was by walking in the light of sound and competent evidence, that all this was accomplished. It was by the patient, the strenuous, the unfaltering application of the legitimate instruments of discovery. It was by touching that which was tangible, and looking at that which was visible, and computing that which was measurable: it was, in one word, by making a right and a reasonable use of all that proof which the field of nature around us has brought within the limit of sensible observation. This is the arena in which the modern philosophy has won all her victories, and fulfilled all her wondrous achievements, and reared all her proud and enduring monuments, and gathered all her magnificent trophies to that power of intellect with which the hand of all-bounteous Heaven, has so richly gifted the constitution of our species."

After the conclusion of Dr. Birkbeck's discourse, the thanks of the Meeting were cordially and unanimously given to all the Officers of the Society. Mr. Marrecco announced the day when the next Meeting would take place, and the company retired. Thus, by the diligence and perseverance of a few individuals, a Society for improvement in chemical knowledge has been successfully established, to flourish and increase, we hope, from year to year. We must always take pleasure and interest in its success, because, though unable to contribute personally to its welfare, the

project for establishing it originated with one of our Correspondents; and perhaps had The Chemist never been published, the Society would never have existed.

[A Correspondent has sent us a communication, of the justice of which we know nothing; but conceiving the hint to be well meant; and to come from a friendly hand, we here insert part of it.]

To the Editor of the Chemist.

I HAVE attended more than once at the meetings of the "London Chemical Society," and, taking them *en masse*, with as much profit as could reasonably be expected; but now that the inauguration has taken place with so much *eclat*, and the officers are regularly appointed, I trust you will afford me sufficient space to express a hope that they will prevent any recurrence of lectures being delivered by persons who are not sufficiently pregnant with the matter to give information in an intelligible manner.

Perhaps I am over sensitive, but I really felt so much pain at the failures of the kind alluded to, that I cannot but hope this hint will prove an effectual preventive of any repetition—as the unfortunate individual so exposing his ignorance is the last to discover that he labours under any deficiency. I am an ardent lover of Chemistry, and have great hopes of the Society, though I am at present no further connected with it than by being an occasional

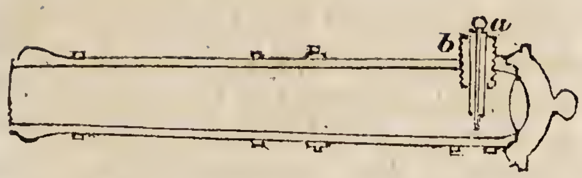
Nov. 27, 1824. VISITOR.

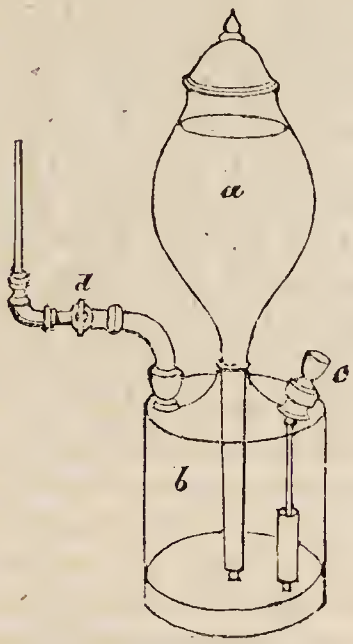
ANTIDOTES FOR VERDIGRIS.

INSTANCES of persons being poisoned by verdigris, by taking food cooked in unclean copper vessels, are now fortunately rare; but they still occur so frequently, that a knowledge of the means of cure when they do occur must be useful. If the poison has only been recently swallowed, the patient should be made to take the white of eggs, dissolved in water, in large quantities, and then provoked to vomit. If the white of eggs is not at hand, large quantities of warm or cold water, or emollient liquids of any kind, meat teas, &c., should be poured down the throat, and the larynx should be tickled, so as to provoke vomiting. If sickness does not take place, an emetic may be given, provided the pains in the stomach are not very violent; when this may do more harm than good. If the poison has been long enough taken to have passed through the stomach into the intestinal canal, and violent colics are beginning, if the patient has already vomited much, vomiting again must not be provoked, but glisters should be administered, and oily and mucilaginous drinks should be given, such as milk and water, in abundance. In the first edition of his celebrated work, M. Orfila recommended sugar mixed with water, in large quantities; but in the second edition, from finding that sugar did not decompose the verdigris, he omitted this remedy. At the same time, the instances he reports of its being efficaciously used, seem so well authenticated, that although theory does not enable us to account for its action, we scarcely refuse to believe in its virtues. In addition, therefore, to M. Orfila's other remedies, we must add, sugar dissolved in water, in large quantities, may be given with advantage, at any stage of the disease.

DIAMONDS IN BRAZIL.

DIAMONDS were discovered in Brazil in 1727, but they were only sought for on the king's account in 1777. They were then found in the Serra Saint Antoine and on the left bank of the river Saint Francois; in the rivers Indaia, Abœta Sono, Prata, Paracatu, and Saint Antoine. These places were all surrounded with guards, as well as the district of Serra de Frio, which has a surface of 100 square leagues. They have since been discovered in several other rivers and districts. The earth in which the diamonds are found is said to be an hydrate of iron, derived from ferruginous schistus.





INFLAMMABLE AIR PISTOL—HYDROGEN RESERVOIR.

THE inflammable air pistol is a convenient instrument for making experiments on explosive mixtures. It consists of a cylinder of brass, about ¾ inch in diameter, and 6 inches long, having the form of a pistol barrel, and mounted like one. A wire, *a*, passes through a tube of ivory, *b*, and an electric spark, communicated to this wire, inflames the mixed gases in the interior. When the experiment is to be made with hydrogen and atmospheric air, it may be charged by previously filling it with dry sand, and emptying it out into a phial of hydrogen, which rises in the barrel sufficiently mixed with with atmospheric air. The muzzle may be secured with a cork, which, on the inflammation of the gas, is expelled with a loud explosion.

The instrument of which the other figure is a representation is useful for charging the electrical air-gun, and in all cases where small quantities of hydrogen are required for burning and other chemical experiments. The funnel-shaped vessel, *a*, fits, by a ground joint, into the three-necked bottle, *b*; to the stopper, *c*, a brass wire is annexed, with a cylinder of zinc screwed on its lower extremity; the mouth, *d*, is furnished with a stop-cock and jet-pipe. The capacity of *a* should be nearly equal to that of *b*, and may contain three or four pints. To charge this apparatus with hydrogen, *b* is to be filled three-fourths with water, and the stopper *c* being removed, a quantity of sulphuric acid, diluted with its bulk of water, is poured in by a long funnel, so that it may remain underneath the water which fills the vessel. The stopper *c*, with its piece of zinc, is then put in, and the hydrogen which is immediately generated forces the dilute acid into *a*, where its pressure serves to propel the gas through *d* whenever the stop-cock is opened. The acid at the same time descends, and produces a fresh portion of hydrogen by again acting on the zinc. This is a convenient instrument whenever we want small quantities of hydrogen, and the electric pistol may be charged by holding it for a moment over the open jet, taking care that there is a due mixture of atmospheric air.

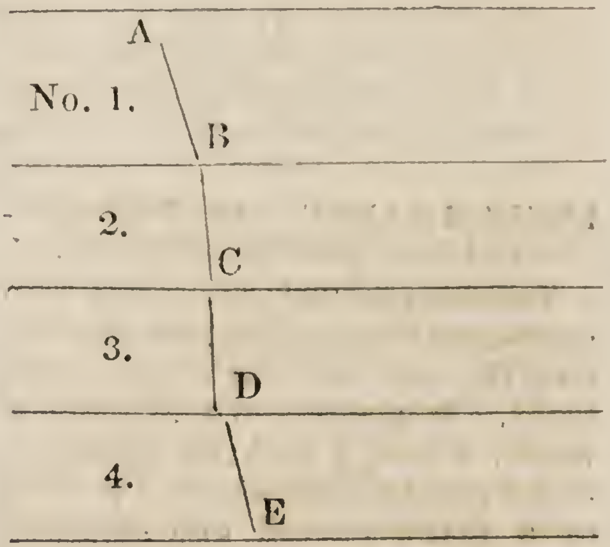
LECTURES AT THE ROYAL INSTITUTION.

RADIANT MATTER, PRODUCING VISION AND HEAT.

LECTURE 13. There were some doubts, Mr. Brande said, as to the causes of those phenomena attributed to radiant matter: by some philosophers they were supposed to have their origin in thin attenuated substances, emanating from other matter; and, by others, to be occasioned by the vibrations of a very attenuated fluid, which fills space. The effects, however, whatever obscurity may lie over the causes, are very familiar, and are now to be considered under the two heads of the phenomena of vision, and of heat. Light comes direct from the sun, the fixed stars, and other luminous bodies, and produces vision in us directly; or it is reflected from other bodies, and thus produces the same phenomena. The manner in which the eye is affected shows that light is trans-

mitted in straight lines. If we cut a hole straight through a piece of wood or other substance, we can perceive objects through it; if the hole, however, be made in a curved direction, or if a substance be divided in that direction, we do not see through it. The rays of light, therefore, move in straight lines; every right line drawn from a luminous body to the eye, is called a ray of light, and the same term is frequently given to a congeries of rays, as they possess the same properties as a single ray. Light is progressive in its motion, and this progression has been measured. By observations on the satellites of Jupiter, it has been found that the real time of their motions round that planet differs somewhat from the observed time, and this difference is proportionably greater as the planet is nearer to or farther from the earth. By such observations, philosophers have calculated the progress of light, and have determined that it requires 8 minutes 13 seconds to pass from the sun to the earth; so that, the moment of our perceiving that luminary above the horizon, or losing sight of him in the evening, is not, by somewhat more than 8 minutes, the actual time of his rising or setting.

Some bodies transmit light, or allow it to pass freely through them, these are called transparent; others allow only portions of light to pass; others again stop it altogether, and are called opaque; and between perfect opacity and transparency, substances are found of every gradation. This difference in bodies has been supposed to result from their different attractive powers for light: some being of a uniform density, attracting the particles of light in every direction equally, and so allowing them to pass through; others attracting them unequally, and causing partial or total obstruction. The progress of light through transparent bodies perhaps confirms this view. When it passes perpendicularly from one transparent medium to another, it moves without changing its direction; but when it passes obliquely from one medium to another, it is thrown out of its old direction. When the ray passes into a denser medium, it is refracted towards the perpendicular, and from the perpendicular, when it passes into a rarer medium; and if it again passes into a first medium, it assumes the original direction. Thus, suppose No. 1 to be air, 2 water, 3 glass, and 4 air: a ray of light passing through the air in the direction A B, will pass through the water in the direction of B C, and through the glass as C D, and, again assuming in the air its original direction, will then proceed parallel to A B, or as D E.



Part of the light which does not traverse bodies is thrown back, or reflected by them, and the angle of reflection is always equal to the angle of incidence. This phenomenon has been compared, but unaptly, to a ball striking the ground, and then rebounding; for is has been proved that the *rays are reflected before they actually reach the surface of bodies.** When a ray of light passes through an oblique angular crystalline body, we find

* We beg leave to call the attention of the reader to this passage, as illustrating what we have said in a note to a former lecture, about not seeing and feeling the same objects. The light by which we see bodies is reflected to our eye by something at a distance from their surface. The same fact, however, shows that the comparison of the ball is not so unapt as Mr. Brande supposes, for, of course, according to what he stated of bodies not being in contact, the ball also bounds from the surface before actually reaching it.

some very curious phenomena take place. The light is divided into two rays: one is refracted in the ordinary way, the other is refracted by a different law, exhibiting the phenomena of double refraction. This may be shown by placing a piece of copper, with a slit in it, behind a transparent crystal of carbonate of lime, when, in consequence of the double refraction, there appears not one, but two slits. The light which suffers this double refraction, exhibits some very peculiar characteristics. If it be received by another crystal, placed *parallel* to the first, the rays are not again divided: but if the second crystal be placed transversely to the first, the ray which was before refracted by the ordinary law, now suffers extraordinary refraction. From its having been supposed that this circumstance is caused by some particular relation between the particles of matter and light, and from some of the properties of light so refracted, it has been called polarized light. Some similar phenomena take place if the light be reflected. If the rays of light from a burning lamp be made to fall on the polished surface of a glass mirror at an angle of 35° 25′, the image of the lamp will be reflected or plainly visible; but if this reflected image, or light, be made to fall on a second mirror, so placed that the ray will fall on it at the same angle, the lamp is not seen as long as the surfaces of both mirrors are perpendicular to each other. But if the reflecting planes are parallel to each other, the image is reflected from the first as from the second. It is observed, generally, that when the reflecting planes are parallel, the light is reflected from both, and when they are perpendicular it is absorbed. On this principle, if the second reflector be made to turn on its axis, the reflected image appears and disappears with its revolution through every quarter of a circle. It would appear from this that certain rays of light pass through glass in one position and not in another; that under certain circumstances, rays of light are absorbed by glass as by other substances, though passing freely through it under other circumstances. This polarization of light, as it has been called, may be destroyed by certain substances. If a thin plate of mica, and of some other crystallized substances, be placed so that the reflected rays may traverse them, in passing from one reflector to the other, the image of the lamp will become visible, or the light will be depolarized in passing through the crystal. This power belongs to substances in one state or condition. Common glass will not depolarize light; but glass subjected to violent pressure, or heated and suddenly cooled, does depolarize it, and is then, as far as this effect is concerned, analogous to crystallized bodies. These effects of light were first noticed by Mr. Malus, and have lately been much attended to by several philosophers, particularly by Dr. Brewster, MM. Arago* and Biot. The

* We have already mentioned the discovery M. Arago is said to have made as to the cause of the sun's light, (see Chemist, vol. i. p. 304.) By a late Number of the *Annals de Chimie*, we are enabled to put the reader more correctly into possession of M. Arago's opinion and discovery:—" On June 14th, this philosopher gave an account to the Royal Academy of France, of which he is a member, of his experiments on light emanating from incandescent bodies. If the bodies are solid or liquid, the light is partially polarized by refraction, when the rays form with the projecting surface an angle of a small number of degrees. As to the light of *inflamed gas*, it offers in no situation any sensible trace of polarization. From these facts, M. Arago deduces, as a consequence, that a considerable portion of the light of incandescent bodies, is formed in their interiors, at depths which he has not yet determined. He has shown that the same mode of observation may be applied to study the physical constitution of the sun; the results which he has obtained confirm the conjectures of Bode, Schroeter and Herschel," &c. So far the Annals. Mr. Leslie, in a very ingenious paper he has lately published, to prove that the light of the moon is not derived from the sun—which we shall hereafter lay before our readers, has acknowledged that M. Arago communi-

student who wishes to inquire further, may consult the *Traité de Phisique*, written by the latter gentleman, which contains, on this subject, a great deal of information.

That the sun-beam is split into a variety of colours in passing through dense substances, such as glass, has long been known; indeed, the rainbow, which has been observed for so many ages, is a specimen of a beautiful natural phenomenon produced by the sun's rays being refracted by the water. To produce a similar appearance by artificial means, we employ glass prisms. And if we receive a beam of light on a prism, and transmit it on to a white paper, or other convenient substance, we shall find that it is always decomposed into seven distinct colours, each of which differs in its refrangibility. These colours are, red, orange, yellow, green, blue, indigo, and violet: the orange, however, appears composed of the yellow and red, and the green of the yellow and blue. The red rays being the least refrangible, fall the nearest to the spot where they would have gone, had the light not been transmitted through the prism; and the violet rays fall the farthest off, being the most refrangible: all the other colours fall between these two points. It has been ascertained, that these rays are not afterwards altered by any number of successive refractions; and if they be all collected, or again refracted to a focus, they produce white or colourless light. On these facts, the common theory of colours is founded. The surfaces of bodies are supposed to absorb some rays and reflect others, the colour they appear of to us depending on the rays they reflect. White bodies are supposed to reflect all the rays, and black bodies to absorb them.

If we examine the rays of the prismatic spectrum by the aid of thermometers, we shall find that each of them differs in its heating power, and this will lead us to the consideration of the effect of radiant matter in producing heat. On moving the hand gently through the beam of light refracted by a prism, we find that it feels warmer as we approach the end, where the rays are least refrangible, or in the red ray. When accurately examined with a thermometer, it is found that the greatest heating power is just beyond the extremity of the red ray. If we assume that the heating power of the violet, or least refrangible ray, equals 16, that of the green ray will equal 26, and that of the red 55, and just beyond the visible spectrum the effect will be still greater. There are rays of heat, therefore, emitted by the sun, which are less refrangible than the rays of light; and heat is perhaps a peculiar and distinct form of radiant matter. From different opinions having been formed on this subject, it has been an object of inquiry to ascertain if the heat and light emitted by terrestrial bodies, were the same as those emitted by the sun. It is clear, from a variety of experiments, that the calorific rays of the solar beam are, like the illuminating rays, capable of refraction and reflection, and are concentrated into a focus, so as to produce intense heat. In many

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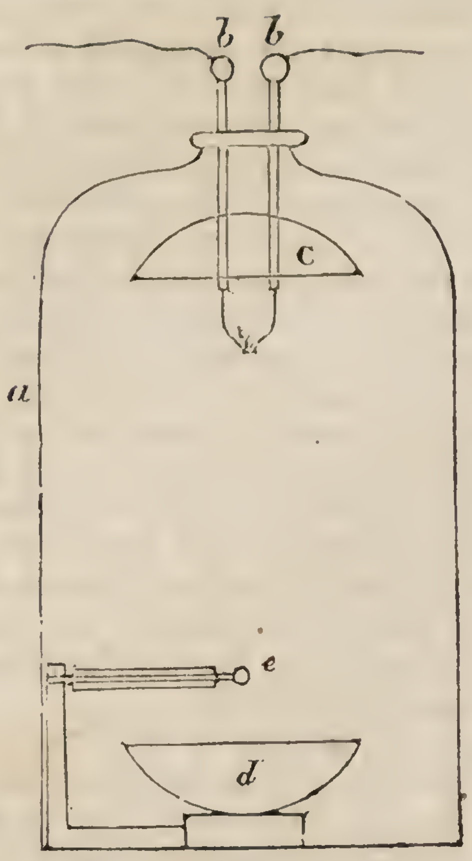
cated these observations to him long ago, and he has drawn some very curious conclusions from them. It is observed, that the light emitted by the sun, like that from *inflamed gas*, displays no trace of polarization till reflected; hence the source of M. Arago's opinion, that the light of the sun is derived from a body of gas in combustion. But it is also observed, that *all* rays from reflected surfaces, not metallic, become polarized, and, unless so reflected, the light of the sun and of gas does not exhibit the phenomena of polarization. Now, Mr. Leslie observes, that before the rays of the moon exhibit polarization, they require to be reflected, whence, he concludes, they have not been reflected at her surface—that they consist, in fact, of her *native light*, which is thrown out when the surface is exposed to the stimulus of the solar beam. The observations, then, on polarized light, which, at first sight, appear so little important, lead to some novel conclusions, and may open up new views that are at present not thought of. We mention this as a motive to such of our readers as have a taste this way to study the phenomena of polarized light.

respects, the radiant matter emitted by terrestrial objects follows the same laws as the radiant matter emitted from the sun. The light of candles and of lamps can be refracted and concentered like the light of the sun. To show the effect of the radiation of heat from bodies, we may place a heated ball in the focus of a concave mirror, and a delicate thermometer in the focus of a mirror placed opposite, when the effect of reflected heat will have a sensible effect on the thermometer. We lately described this experiment in The Chemist, and shall not now repeat it, but shall content ourselves with observing, that the experiment was performed by a ball scarcely heated to redness, the mirrors being about 10 feet apart, and a considerable effect was immediately visible on the ball of the air thermometer, placed in the focus of a second mirror. It had been indeed observed, Mr. Brande continued, that the sun's heat passed immediately through glass, while the heat from terrestrial objects was arrested by it. But this was rather owing to a difference in intensity than in the nature of the two substances, for the heat of a very bright *gas* flame will pass as rapidly through glass as the solar ray. The heat also emitted by all terrestrial bodies passes through glass, after the glass has been a short time exposed to its action, as well as solar heat.* To show the radiation of heat from terrestrial objects, and its powerful effects, the best and fairest mode is to place the two mirrors eight or ten feet apart, in a perpendicular line, and place some ignited charcoal in the focus of the upper mirror: we are then sure that none of the heat can descend but that which is radiated from the upper mirror. On placing some phosphorus, however, or other inflammable matter, in the focus of the lower mirror, it is presently ignited. This experiment was performed, and some phosphorus placed in the focus of the lower mirror set on fire. The mirrors were about two feet in diameter, and made of tin.

In explanation of the mode in which this effect was produced, Mr. Brande explained that it was supposed the surfaces of all bodies were constantly throwing off radiant matter; and we might conceive the hot ball which had made the thermometer rise, in a situation where it would be cold with relation to all the surrounding bodies, and that then placed in the focus of a mirror, it would make the hotter body in the other focus sink in temperature. On this principle, the effect of a ball of snow, or frozen mercury, was explained, and when either of these was placed in the focus of one mirror it had the effect of sinking the thermometer placed in the other. To show that radiant matter did pass from all bodies, independently of the air, Sir Humphry Davy made the following experiment: — He placed two mirrors, C *d*, in the receiver of an air-pump *a*; in the focus of *d* he placed the thermometer *e*, and he ignited charcoal in the focus of the upper mirror C, by means of Voltaic electricity, transmitted through the two wires *b b*. On exhausting the air to 1-120th of its volume, he found that the effect of the burning charcoal was nearly three times as great on the thermometer placed in the opposite focus as when the air was in its natural state of condensation. One conclusion deduced from this experiment was, that Mr. Leslie's

* We apprehend, also, that the passage of heat in one case, more rapidly than in the other, may arise from the state of the glass, and not from any difference in the light and heat emitted by the sun and other bodies. When the glass is exposed to the sun's rays, it is, if we may so speak, already saturated, being of the same temperature with the surrounding air and with the rays; but when we expose glass to artificial heat, we expose it suddenly to a temperature extremely different from its own, and it does not transmit that heat till saturated with it. We see, that when it has acquired the same temperature, it transmits the heat of fires and lamps, as well as the sun's heat. Mr. Brande has shown that the heat of a bright gas flame passes almost instantly.



theory of radiation, which supposed it to be occasioned by vibrations in the air, was completely disproved, as here the radiation was more rapid in proportion as the air was removed.

The solar heat, it is well known, causes a rise of temperature in bodies in proportion as their colour is dark. The phenomena of radiation from terrestrial bodies has been much attended to by Prof. Leslie, who has shown that it depends on the nature of the surfaces of bodies. The polished mirror which produces so much heat in its focus, is itself not heated; but if this mirror be coated with isinglass, or paint, or paper, for example, it absorbs all the heat it receives, and there is none in the focus. Professor Leslie found that a clean metallic surface, exposed to heat, was affected much slower and less than when covered with a coating of isinglass, of glue, or of lamp-black. This is an experiment easily made, and it is only necessary to cover the bulb of a thermometer with the various substances the effect of which is to be ascertained. There are various degrees in which different substances receive heat, which it is useful to know in practice. For example, however bright we may keep the inside of our kettles and caldrons, for the fire to have the greatest effect on them, the outsides must not be polished. Professor Leslie has shown that this effect does not depend on the colour of the surface, but on its mechanical structure. Thus white paper has nearly an equal effect with lamp-black, and other coloured papers have the same effect as white, provided their texture be the same. As might perhaps be expected, Mr. Leslie also found that substances which received least radiated heat gave it out least readily. Thus a metallic vessel, having one of its sides polished, another covered with isinglass, a third with lamp-black, and filled with hot water, gave out most heat at the side covered with the lamp-black, and least at the clean metallic surface. The radiating power of surfaces is equal to their receptive powers; and this, too, is a fact of some importance in practice. Vessels, such as tea-pots, dish-covers, and all others which we wish to retain the heat, should be kept bright and polished, while those we wish should part with their heat, such as steam-pipes for heating buildings, and other things of the same nature, should be kept black or painted.

DICTIONARY OF CHEMISTRY.

Damps. The name given by the miners to those permanently elastic fluids which are extricated in mines, and are destructive to life. *Choak damp*, which extinguishes flame, and hovers about the bottom of mines, is chiefly carbonic acid gas; while *fire damp*, which explodes on coming in contact with light, is mostly hydrogen.

Daourite. A variety of red shoal, found in Siberia.

Daphnin. The bitter principle of the *daphne alpina*, discovered by M. Vauquelin.

Datolite. A mineral procured in Norway, consisting of silica 36.5, lime 35.5, boracic acid 24.0, water 4, with a trace of iron and manganese.

DATURA. A vegeto-alkali, obtained from *datura-stramonium.*

DECANTATION, is pouring off the clear part of a fluid from the dregs, residuum, or precipitate.

DECOCTION. Extracting the properties of plants, herbs, &c. by boiling; the liquid, after boiling, becoming a *decoction* of the substance boiled in it.

DECREMENTS, in crystallography, the strata, or additional crystals, which, clustering in various directions around the original crystal or nucleus of any substance, give to it various mathematical forms.

DECREPITATION. Various salts, when heated, burst or break with a considerable noise, and their whole surface is exfoliated. This was ascribed to the water they contain becoming steam; but as it takes place most frequently in salts containing no water, this explanation is given up, and the effect is now attributed to the salts being, like glass, bad conductors of heat, and therefore, like it, breaking when suddenly exposed to its action.

DELPHIA, *delphinia.* A vegetable alkali, discovered by MM. Lassaigne and Feneulle in the *delphinium staphysagria*, or *stavesacre.* It may be procured by bruising the seeds, pouring on them and the shells dilute sulphuric acid, and precipitating by subcarbonate of potash. It is, while wet, crystalline, and its taste is bitter and acrid.

DELIQUESCENCE. The spontaneous conversion of certain dry salts into a liquid form, by attracting moisture from the air.

DEPHLEGMATION. Among the old chemists *phlegm* was an element, and dephlegmation was depriving them of phlegm; and as water was most generally the fluid which diminished the energy of the substances on which they operated, dephlegmation came to be synonymous with any mode of depriving substances of water.

DEPHLOGISTICATED. Phlogiston was the name of another imaginary element, in the older systems of chemistry, and "dephlogisticated" therefore meant "deprived of phlogiston." It has no meaning independent of this theory; but most of the phenomena formerly attributed to phlogiston are now known to be caused by the union of oxygen with bodies, and therefore *oxidized*, or *oxygenated*, is in some measure synonymous with *dephlogisticated.*

DEPHLOGISTICATED AIR. According to the theory of phlogiston, air deprived of this element is now called oxygen gas.

UNHEALTHY EFFECTS OF WATER KEPT IN IRON TANKS.

WITHIN a few years wooden casks, for the preservation and stowage of water on board ship, have given place, both in England and France, to iron tanks. With the former, it was impossible to keep the water pure for any length of time. The juices of the wood were mingled with the water; they were decomposed, or putrefied, and the water became disgusting and unhealthy. Iron tanks were supposed to possess none of these inconveniences. It is, however, stated in a French Journal, that not only are they very expensive, in consequence of being speedily destroyed by rust, but the oxide forms so large a deposit, that one-sixth of the water is always wasted, and the whole adds to that costiveness which is an almost habitual complaint of seamen. The same journal, however, states, that a M. Ledeau has discovered a species of varnish, to be applied to the inside of the tanks, which will prevent oxidation, and preserve the water sweet any length of time. The secret is not disclosed, but a trial is now making on board of the squadron commanded by Baron Duphene.

TO MAKE OLD PORT WINE OUT OF NEW.

WE shall perhaps do no disservice to the health of His Majesty's subjects, by informing the wine merchants of another easy and not baneful method of converting their new wine into old. The effects of heat in doing this have already

been recorded, (vol. i. p. 335.) Boiling wine, or exposing it to the sun, both mellows it and makes it light coloured. Another means of effecting the latter is to strain it through powdered charcoal. The charcoal should be fresh burnt and carefully dried; and then, though it will immediately convert new port into delicate tawney, it will impart no improper taste to it, and give it no deleterious qualities. The merchant may adopt any sort of mechanical means he pleases to filter the wine through the charcoal; and if he does not find it light coloured enough by the first operation, he may filter it a second time, and may entirely abstract the colouring matter by repeated filterings.

CAUSES OF HYDROPHOBIA.

The alarming nature of this disease, and the exaggerated and incorrect rumours which are sometimes spread concerning it, makes every sort of correct information of great value. We shall therefore transcribe from the pages of a popular periodical work a few articles giving an account of its causes, symptoms, and means of cure. The animals most subject to hydrophobia are the dog, the wolf, the cat, and the fox; and we are yet ignorant of the original cause of the disease, though we know when once it exists that it is communicable. It has been said to appear most frequently during the heats of summer and autumn, and rigorous cold of winter; but it is rare in Jamaica, has never been known to occur in Antigua, Syria, or the Cape of Good Hope; which seems to prove that it is not caused by excessive heat. In a Memoir by M. Trolliet, it is stated that the smallest number of cases occur in January and August, the hottest and coldest months of the year. In wolves it has been observed most frequently in March and April, and in dogs in May and September; and from the united researches of the physicians of all Europe, the disease seems most common in temperate climates. In Poland it is extremely rare. It does not arise from want of water, for dogs have been kept upwards of forty days without water, and have not become mad. They have also been fed for several days together on putrefied animal substances, and have betrayed no symptoms of the disease. All the causes usually assigned must therefore be regarded as insufficient; and we must admit that the origin of this terrific disorder is as much hidden in obscurity as the means of cure.

AMERICAN MECHANICS.

From a Report lately published, it appears the Apprentices' Library in New York, United States, which was established in 1820, now contains 6000 volumes of standard works: it numbers 1400 readers; the expense is about 400 dollars a year. During the last year the number of books added was 638; the number lost and missing, 25 volumes. The report adds, that the apprentice boys conform to the rules of the library, and behave remarkably well. London is not yet on a par with New York.

TO CORRESPONDENTS.

We are requested to inform the "Querist" on the subject of purifying Rape and Linseed Oils, (inserted at p. 152,) that if he will address a line to L. M. R. to be left at Peel's Coffee-house, Fleet-street, naming when and where he may be seen, and allowing a week for the due receipt of his note, he will probably obtain the required information from a Correspondent who signs

Amicus.

"Speculator" in our next.

"Οὐδεὶς," "A Subscriber," and "A Constant Reader," have all been received, and shall be attended to in our next.

*** Communications (post paid) to be addressed to the Editor at the Publishers'.

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The Chemist.

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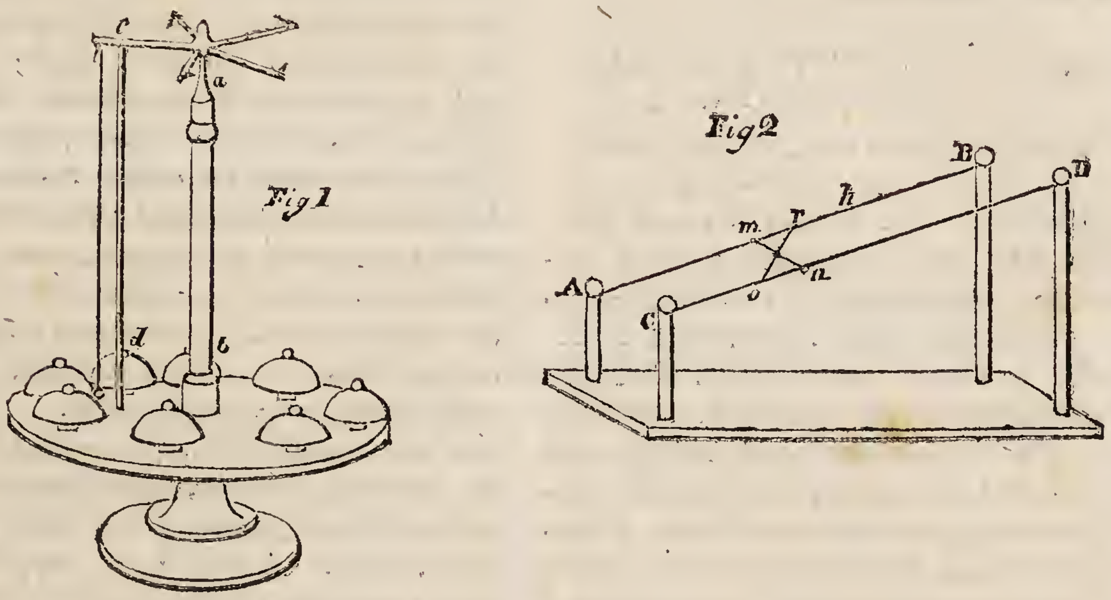

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MORE ELECTRICAL EXPERIMENTS.

INSERT five arms of wire, having their extremities pointed and turned in the same direction, into a piece of wood supported upon a point at the top of a glass pillar, as shown in Fig. 1. To one of these arms, which is longer than the rest, suspend a glass clapper by a silk thread, and behind it a rod *c d*. Let eight bells be now placed upon the stand, and if a chain passes from the upper point *a* to the prime conductor, the points will move round, and the glass clapper will strike against the bells during its successive revolutions.

Fig. 2. Let an inclined plane be formed of two straight parallel wires, AB, CD, and insulated by four glass pillars A, B, C, D fixed in a stand; and let a small wire, *r m n*, with two little balls at its ex-

tremities, be made so as to slide down the parallel wires by the force of gravity. On a pivot in its centre, balance a wire *o p* with two points turned in the same direction. When the wire *m n* is near the lower end of the inclined plane, connect the parallel wire with an electrical conductor by means of a chain. The wire *o p* will immediately turn round the pivot upon *m n*, and will ascend the inclined plane.

LECTURES AT THE ROYAL INSTITUTION.

RADIANT MATTER PRODUCING CHEMICAL EFFECTS.

Lecture 14. In my former Lecture, Mr. Brande said, I have described the properties of bodies as to radiating and absorbing heat; and I pointed out to you that the radiating power is much, perhaps ten times greater, from rough and darkened surfaces, than from metallic and polished surfaces. I also pointed out to you that the colour of those bodies which are exposed to the solar beam has an effect on their heat; that dark bodies absorb more light than white ones, and that bodies which absorb most light have their temperatures most raised. If we take three thermometers, one of plain glass, another with a metallic coating, such as silver leaf, and a third having its bulb blackened, and expose them all to the same quantity of radiant matter, we shall find that they each rise to a different degree, the mercury in the blackened bulb rising higher than that in the plain glass, and that in the plain glass higher than that in the bulb coated with metal. By the heat arising then from the light of the solar beam, absorbed by the blackened bulb of a thermometer, we may form a judgment of the relative quantities of light. On this principle, Mr. Leslie has constructed his photometer, which is nothing more than a very delicate and small differential thermometer, inclosed in a glass tube, having one of its bulbs blackened. The instrument is kept in a case, and on being exposed to light, the blackened bulb becoming warmer than the other, indicates the degree by the depression of the fluid. On uncovering this instrument, even to the light of the room, it is affected; it is very much affected by the light of a clear day, and instantly rises again when a cloud passes over the sun, or if any other event happens to obscure the light. Although it is affected by artificial light, it is not a very accurate instrument for measuring its illuminating powers; and when we require to do this, as in making comparative estimates of the light of candles or lamps, we must have recourse to other methods.* In all thermometrical experiments, also requiring precision, care must be taken that the bulbs of the thermometers are alike, and not exposed to any circumstances making their radiating power different.

Phenomena of dew.—The earth, as is well known, absorbs a great quantity of heat from the sun's rays, and, as might be expected, also possesses considerable radiating powers. In fact, the radiation of heat from the surface of the earth has considerable influence in the production of several natural phenomena, to some only of which I am enabled, by the shortness of our time, to call your attention. One of the most curious of these is the falling of dew. It is generally supposed, that the air, charged with moisture, grows gradually cooler, as the sun's beams are longer withdrawn, and, as its temperature is lowered, deposits the vapour it contains in the same manner as it precipitates showers of rain. This does not, however, appear to be correct; and dew is rather the effect of a change of temperature on the earth's surface, occasioned by its radiating powers, when the

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* The reader will perhaps recollect that there is at this moment a keen controversy carrying on as to the illuminating powers of oil and coal gas, and that the instrument used by Mr. Leslie is the photometer described in the text, but used under some peculiar management or use of screens which has not yet been explained.

dew is deposited on it by the warmer air, just as we see a vessel, filled with cold liquid, condensing on its surface the vapour of the atmosphere of a warm room.—When the radiating powers of the earth makes it throw off its heat till it becomes colder than the circumambient air, dew is deposited. As we have already seen that different surfaces possess a different radiant power, so some parts of the earth's surface radiate more heat than others. Common soil has one radiating power, pavement another, gravel another, and grass a different one from them all. Modifications of temperature depend on these variations of the surface, and must be taken into consideration. The means of judging of the radiating power of different surfaces is to place some substance on them which has a great affinity for moisture. Take a piece of wool, for example, and it will be found that it acquires a different quantity of moisture on different surfaces. If laid on grass it will become heavier than if laid on the gravel walk close to it. To produce dew, it has been observed, that a clear sky is necessary: the earth then radiates heat more rapidly; and if clouds come over, the radiation diminishes or ceases altogether. Dew never falls whenever there are both clouds and wind. When the sky is perfectly clear, and the atmosphere quite calm, the temperature of the earth's surface is always much below that of the air, and then dew is most copious. Clouds collecting or forming over the heavens, diminish the radiating powers of the earth, and then it and the air are more nearly on an equality of temperature. Any artificial covering has the same effect as the clouds; and gardeners, without knowing perhaps the principles on which they do so, cover over the young plants with mats, and thus prevent the radiation of the heat, and preserve a higher temperature under the mats than on the uncovered surface of the earth in the neighbourhood. The quantity of dew depends on the moisture in the air; and when this is abundant, a much less difference of temperature between the earth's surface and the air is sufficient to make dew be deposited, than when the air is dry.

Different plants also, as they grow, are found to possess different radiating powers, which have no inconsiderable effects on their healthy vegetation. The leaves of some radiate the heat much more rapidly than others, and thus their surface collects more or less dew; and when the temperature is sufficiently low, more or less hoar frost. Plants standing close to one another are found to differ in this respect, and the great radiating power of some may assist in their destruction.* In 1821, I made some experiments, which I cannot at present detail, but will merely state the results. At 7 o'clock in the morning the temperature of the earth was at 38°, that of the air 55°; the leaves of a sunflower were at 36°; a common cabbage 34°; and a large leafed geranium was at 30°, and covered with a hoar frost. We also find that the surface of the earth is sometimes covered with hoar frost when the temperature of the air is much above the freezing point; but, if the surface of the earth be then examined, it will be found below it; and the difference between the temperature of the earth's surface and the air, amounts sometimes to 30°. In consequence of this, it happens that the lower strata of air are frequently colder than those above. As calmness is necessary to the radiating power, and is diminished by the wind blowing and the air changing, we see a reason, also, why dells and hollows, from which the air does not escape, and there is no current or wind through them, suffer more from radiation than more exposed places. Plants in such spots, where we should think them protected from the wind, are there found very

* It is found, by some late experiments, that the radiating power of the corolla or flowers of plants, differs, as might have been expected, from the radiating power of their leaves.

often to perish. It is on the principle of radiation that ice is made in India. A surface is chosen, which is favourable for the purpose, it is protected by a wall from currents of air, and then water is placed in clear white vessels on a surface of chopped straw, that being favourable to radiation. Even in that climate, if the night be calm and clear, the surface of the water is found in the morning, covered with a thin crust of ice, and in this manner water is frozen to supply the luxuries of the table.

Radiant matter also effects chemical changes in bodies, and I shall now proceed to speak of its effects in producing such changes. The substance called chloride of silver, while kept in a dark place, remains white, but becomes dark, and is partially decomposed, whenever it is exposed to the light. Scheele, I believe, was the first to observe, that when nitrate of silver is exposed to the rays of the prismatic spectrum, it is decomposed; but the effect is most powerful in the violet ray, and least in the red ray. It has been since ascertained, that the most powerful effect is produced a little beyond the extremity of the violet ray, just out of the visible spectrum. There are then rays distinct from the visible rays which have the effect of producing chemical changes, and thus the solar beam may itself be decomposed into three distinct rays; heating rays, colouring rays, and rays producing chemical changes. All these rays are susceptible of refraction, reflection, and the other mechanical properties ascribed to light. The chemical effects of light are very distinct on a mixture of hydrogen and chlorine. If equal volumes of these gases be mixed and kept in a dark room, they combine very slowly indeed, producing muriatic acid; if carried into the light, their union is more speedily effected; and if exposed to the direct rays of the sun, the combination takes place very rapidly, and sometimes instantly, with a considerable explosion. From the different effects produced at the different ends of the prismatic spectrum, Sir Humphry Davy has been led to remark, that there exists a considerable analogy between it and the opposite poles of a Voltaic battery. He has observed, that some metallic oxides are affected in the violet extremity of the spectrum, as if they had been exposed to a current of hydrogen; and when exposed to the red rays, they acquire a tendency to absorb oxygen. In the Voltaic circuit there is in the centre a neutral point, so in the middle of the spectrum there is also a sort of neutral point; while there is in it also, as in Voltaic electricity, at one end a power of combining with oxygen, and at the other a readiness to inflammability, similar chemical effects being produced by negative electricity and the most refrangible rays, and by positive electricity and the least refrangible rays. Morichini has even asserted that the violet ray excites magnetism. Other persons, too, are said to have succeeded in making the same experiment; but in this country it is difficult to get a solar beam of sufficient power, and here the experiment has not succeeded. This then is yet a doubtful point; but if it should be established, it will add one more circumstance strengthening the analogy already pointed out between the effects of the spectrum and those of electricity.

In nature, the chemical changes produced by the action of light are neither few nor unimportant. Vegetables, it is found, grow better and more vigorously in the light than in the shade. Plants cultivated in the dark, are deficient in lustre, fragrance, colour, and taste; and even the form of their leaves differs from the form of the same plant, cultivated under the sun's rays. A plant was given to Dr. Black, which had been brought up from some mine as an unknown species: it was examined, and so regarded. After a time it died, and there sprang up from it a common tansy; such, then, was the effect on plants growing out of the influence of light, that their appearance and

nature were entirely changed. This may be seen, when potatoes grow in our cellars; they then send forth long white purplish shoots quite different from the shoots they send forth in the light. This effect of darkness is sometimes advantageously employed by gardeners, when they wish to diminish the intensity of the peculiar flavour of plants. Celery, for example, is carefully covered up with earth from the light, and the consequence is that the lower and hidden part, which would be otherwise fibrous, hard, and bitter, becomes soft, succulent, and with just so much of its peculiar aromatic taste as renders it agreeable. Endive is bleached and softened on the same principle, by being covered with a tile. In cabbages we see this effect naturally produced: the heart of the cabbage is white and soft, while the outer leaves are coarse, strong, and of a lively colour. Light is not less necessary to animals than to plants. Miners and others, who live or work much under ground, are pale and sallow, and are subject to peculiar diseases. Animals, which live out of the light, are of a dingy, disagreeable appearance; while those which live in it are of more cheerful hues. In countries where the rays of the sun are brilliant and intense, we find birds of the gaudiest plumage: more sober tints distinguish the feathered tribe as we approach the polar regions; and all animals which dwell beneath the surface, hid from light, are of a dull and dingy appearance.*

The Professor passed on next to consider the phenomena of luminous bodies, and the nature and properties of flame. Many bodies, when heated to a certain point short of that at which they undergo combustion, become luminous: such bodies are said to be phosphorescent. The heat requisite for this is short of a red heat. One kind of fluor spar in powder, thrown on a hot plate of iron, heated to about 400, gives out a faint purple light; another emits a red light, like sparks. Marble, phosphate of lime, and several other substances are luminous when exposed to a certain degree of heat. Sugar is made luminous by electricity. If an electrical spark be passed through sugar, it is afterwards found to be luminous in a dark place. There is another class of phosphorescent substances, called solar phosphori, from becoming luminous in the dark, after having been exposed to sunshine. Canton's phosphorus, and the Bolognian phosphorus, are of this description. The latter was discovered accidentally at Bologna by a shoemaker's maid, in calcining sulphate of baryta. Oyster shells calcined, and reduced to powder, make a good phosphorus; but the light it gives out varies under different circumstances: the oyster shells which have been in contact with the iron bars of the furnace even giving a different light from the others. It has been supposed that the light is absorbed in such bodies, and afterwards given out; but this cannot be admitted; and it seems more reasonable to suppose that any particles violently expelled into space, may exhibit the phenomena of radiant

* It has been remarked by Humboldt, and various other travellers, that the inhabitants of the warmer regions, where the people necessarily live much in daylight, seldom retiring to a hut even to sleep, are straighter and better formed than the inhabitants of colder countries, which they attribute to the influence of light and heat. That light has a powerful effect on the health of man may be easily perceived from the deficient colour and deficient vigour of those people who are encaged in the narrow streets of a crowded city. How cruel then is every thing which, like the late window-tax, serves to deprive people both of light and air; or, in other words, both of health and vigour. There is a French philosopher, of no great reputation however, who is the author of a theoretical system of the universe, which supposes the whole to be under the influence of laws of compensation. Had he seen that the discovery of Dr. Jenner, which has extirpated the small pox, was about coeval with the imposition of the window tax, we have no doubt he would have found the latter a compensation for the former, in order to preserve in the world the due proportion of sickness and misery.

matter; and that, in this case, the light is the result of some mechanical or chemical action. There is another class of bodies which are spontaneously phosphorescent, such as some animals, and some vegetables, and particularly fish, when about to putrify. Some animals, as the glowworm, have a phosphorescence which seems under the control of their will. There are one or two other sources of light which may be mentioned, such as percussion and friction. Two pieces of sugar or of calomel, or two pebbles, struck or rubbed together, emit light. These cases are not analogous to the emission of light by the fluor spar, for there it seems to take place independent of any increase of temperature.

It has been questioned whether air can become luminous; and it has even been denied that gaseous matter is capable of becoming luminous. But this seems incorrect. What, I would ask, is flame but luminous gaseous matter? It is certainly requisite that the temperature should be very high before air becomes luminous, but, that condition fulfilled, gas may be incandescent. The heating power of flames is not in proportion to their brilliancy, and the most brilliant flames are those of the lowest temperature. Perhaps the purest flame, and of the highest temperature, is furnished by the combustion of hydrogen gas, or of spirit of wine, which are but little luminous: the luminousness of flame depending on some solid combustible matter in it, which in ordinary flames, such as gas, tallow, wax, &c. depends on very finely divided charcoal. If into the flame of a spirit lamp we put a solid combustible matter, such as charcoal powder, its luminousness is instantly increased, without any increase of its temperature. That the intensity of the heat in such flames as those of hydrogen and spirit of wine is very great, may be shown by introducing into them some fine platinum wire, which is instantly rendered white hot in those parts of the flame where the combustion is most perfect. By holding it even over the flame, it is rendered red hot. A curious experiment on this subject is this: Pour a small quantity of ether in a tall glass, and suspend just above the surface of the liquid a platinum wire, heated red hot: the wire continues to glow till all the ether has passed off in vapour, or till it has acquired a white heat, when the vapour of the ether inflames. This shows what a high degree of heat, a degree beyond that of platinum white hot, exists in flame. The Professor made this experiment, but the ether did not inflame, owing, as he explained, to a rapid current of cool air passing through the room. The morning was cold. The same experiment shows, not only that an intense degree of heat is necessary to flame, but that, if we can cool gaseous matter down below this inflammable point, we shall extinguish it. Metals being good conductors of heat, answer the purpose of cooling flame. A fine metallic wire gauze, which transmits the heat communicated to the wires adjacent to the flame through every part of the gauze, spreads it abroad, and prevents the wire from ever becoming so hot as to inflame inflammable gas. On this principle Sir Humphry Davy constructed his safety lamp; and the higher the temperature of the flame, the finer must the gauze be.—(Here Mr. Brande exhibited those experiments which have been given in our No. 38, p. 150.)

I have already shown you that the temperature requisite to make gases inflame is very high, and another proof of it may be shown by what has been called the aphlogistic lamp. It consists of a spirit lamp, and a small coil of platinum wire; I place the wire over the flame, and it extinguishes it, but becomes heated, and continues red hot as long as the vapour of the spirit is supplied, and never sets it on fire. It is a somewhat remarkable circumstance, that the chemical products of this species of incomplete combustion are different

from the products of complete or ordinary combustion. You observe, that even with the small quantity of spirit of wine used, there is a pungent odour diffused. Now the principal product in this case is acetic acid, or vinegar; in other cases of combustion of the same materials, we find no trace of vinegar, but carbonic acid. The products therefore depend on combustion.*

I shall hereafter more specifically call your attention to the construction of Sir Humphry Davy's safety lamp. At present I only wish to point out to you the principles; and having shown you the powerful agency of metallic wires in cooling down flame, so that it is extinguished, I shall only briefly advert to the steps by which Sir Humphry Davy was led to the discovery of the safety lamp. On making some experiment with an inflammable gas, he observed that the flame communicated at the end of a long narrow tube, did not pass into the gas, and that an explosion was thus prevented. This led him to try the effect of tubes on explosive mixtures, and he found, that when made proportionally long and narrow, the flame never passed through them. Preserving his tubes, with the same bore, he gradually reduced them in length, to ascertain to what extent this power of preventing the flame went, and he cut them down till he came to something resembling a wire gauze. This may be considered as a collection of a great number of metallic tubes, and through it flame will not pass so as to ignite an inflammable gas. By inclosing a lamp with wire gauze, then, it may be carried into inflammable air without danger; and this is the miner's safety lamp.†

* This is a fact of consequence in manufactures; as it shows that the products of art, which are supposed to exist, ready formed, in the substance from which they are distilled or obtained, are, in fact, *created* by us. We have, in our article on the manufacture of Pyroligneous Acid, vol. i, p. 264, already stated a similar fact. With one degree of heat we obtain from wood vinegar, with another carbonic acid.

† This short history of a most valuable and useful discovery, shows by what successive steps an intelligent and skilful man is led from one trivial and chance-begotten occurrence, which he knows how to interpret, to a great and permanent improvement. The safety lamp was not discovered at one heat. There is nothing in the whole process like what is usually understood by the term *genius* or *inspiration*; but there is a series of observations, the result apparently of plodding, pains-taking attention, such as every man appears capable of. The discovery is not the less valuable, or the series of observations less acute, because the whole process, from the beginning, is so clear and comprehensible; on the contrary, it appears to us more valuable, as being nothing out of the reach of ordinary men, who may all hope, if their attention be so directed, to make similar discoveries. The whole matter also is a type of what takes place in the general progress of mankind. The only difference is, that the successive steps are then made by different generations, while in this case they were all made by the individual.

CHEAP ELECTRICAL JARS.

To the Editor of the Chemist.

Sir,—I embrace a few moments of leisure to send a communication, which may perhaps be acceptable to some of your readers. Every one concerned in philosophical pursuits knows how expensive the apparatus and instruments necessary in making experiments are. I, for one, have found it so; and, from a consideration of the "res augustæ domi," have been induced to employ a variety of expedients and contrivances to enable me to pursue my speculations without dipping too deep into my pecuniary resources.

Amongst other contrivances to save expense, I have one which I am about to communicate, which, I doubt not, will be acceptable to many who, like myself, are fond of philosophical investigations; but, like me, not blessed with a superfluity of that necessary article, which even philosophers cannot do without—money!

I had long wished to construct electrical jars upon an economical

plan, finding the cost, and loss by breaking, of the common jars, very burthensome. I wished also to possess a battery upon a large scale; but this I found a very formidable affair, to a pocket so thinly *coated* with the precious metals as mine is. I had looked, with a wistful eye, at the green bottles which are used for wine, &c. thinking they might be made useful in a way the manufacturers never dreamt of. After much pondering, and many trials, I at length succeeded in converting a wine bottle into an electrical jar; and you cannot conceive, Sir, how delighted I was at seeing my acquaintance, the bottle, wearing a shining coat on the *outside*, having hitherto worn a coat of a different complexion, and being now filled with a fluid, of a nature altogether different from its usual contents, yet more crackling and sparkling. Champaign is tame and flat in comparison with it! I was as much elated as if I had emptied it of the best Falernian. But to my plan:—A common green bottle, which costs 3*d*. or 4*d*., may be coated on the outside with tin-foil, or thin sheet-lead, such as is used by tea-dealers; which may be attached to the bottle with common flour paste, without any *resin* in it, as high as the shoulder, taking care that the upper edge is cut smooth and laid on even. Now, as coating the inside with the same material is a difficult matter, on account of the narrow neck which these bottles are made with, I tried iron turnings, but found these alone would not do, owing to the number of points they presented at the surface, by which the electricity was discharged, before any considerable quantity could be obtained. Having found, by former experiments, that water will hold a certain portion of electricity, I put into a bottle, coated as just described, about a pound of iron turnings; then filled the bottle with water, as high as the outside coating, and corking the bottle, I passed a stout brass wire through the cork till it came in contact with the iron-turnings; and then screwing a ball, or knob, to the top of the wire, I had the satisfaction to find my electrical bottle answer, in every test which I put it to, quite as well, and it holds as powerful a charge as any other electrical jar, with an equal quantity of coated surface, which I had hitherto tried. I have since constructed a battery of twenty-five of these bottles, prepared in like manner, and find it exceedingly powerful; and have performed most of the experiments described in works upon electricity, which require a powerful battery.—Thus, I can, for sixpence, have a jar as effective as those which, made of white glass in the usual way, cost as many shillings, and a battery as cheap in proportion.—I have also a diamond spotted jar, constructed with similar materials, which cost me about 9*d*., and which, owing to the black colour of the jar, shows the beautiful scintillations and coruscations of the electric fluid, in a much more beautiful manner than those made of white glass, and which cost from six shillings to half a guinea.

I am, Sir, yours, &c.

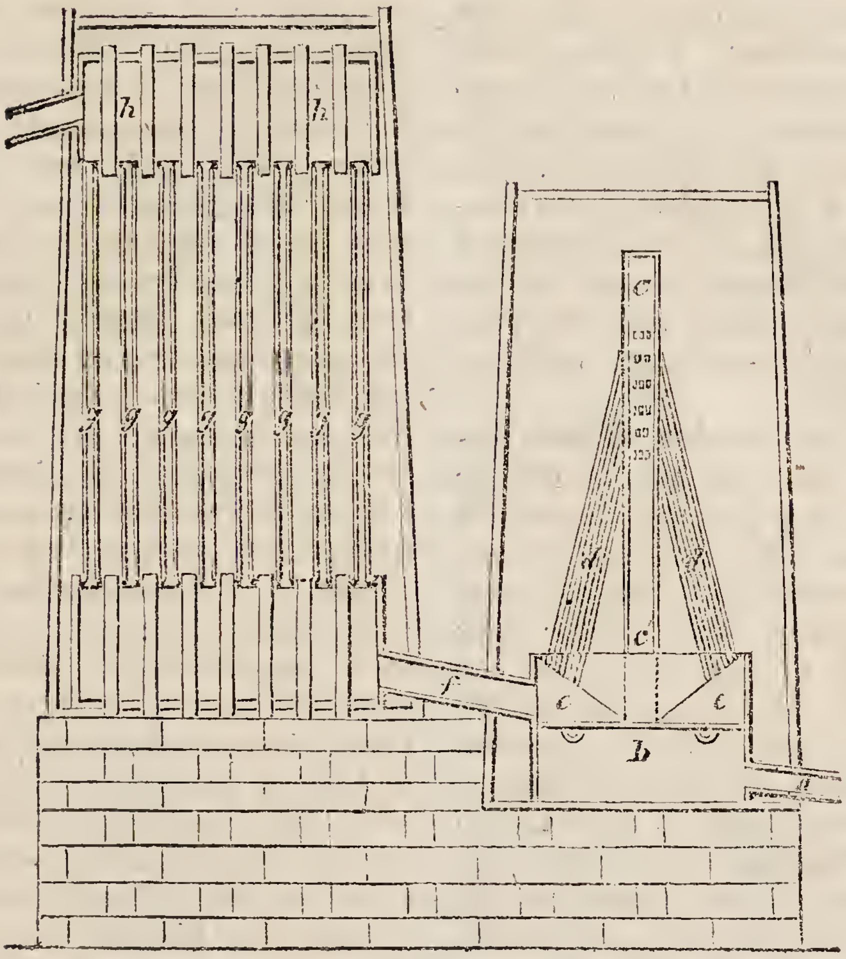
TYRO-CHEMICUS.

EFFECT OF DILATION IN PRODUCING COLD.

M. GAY LUSSAC has shown, by a very curious experiment, the effect of dilation in producing cold. He directed on a glass ball a small stream of common air, which issued through a narrow aperture from a vessel containing this air very much compressed, and the degree of cold produced on the glass was so great, that the water of the atmosphere was instantly deposited on it in the form of ice.

TO MAKE NITROUS ACID GAS.

TAKE a glass globe, and exhaust it over an air pump; then admit into it, from a graduated jar, two volumes of nitric oxide, and one volume of oxygen; the two combine immediately, and form nitrous acid, filling the globe with a deep orange coloured ar



WINTER'S IMPROVED DISTILLATION.

For the following description and accompanying Plate we are indebted to the London Journal of Arts and Sciences. We shall observe of Mr. Winter's patent process, that it is neither so economical nor so scientific as that of Derosne, already described in our work; and had Mr. Winter been aware of Derosne's application of the principle of alcohol being converted into vapour at a lower temperature than water, he would never have employed all the pipes and tubes which seem the peculiar mechanical feature of his invention. The patentee states, that by the present modes of distillation, the vapour, on leaving the still, enters the condenser immediately, where it is condensed into what is technically called low wines and faints, and that it is necessary the operation should be repeated several times, in order to obtain the whole of the spirit in a high state of rectification; his object, therefore, in the present improved process, is to produce the spirit in a perfect and highly rectified state at one operation, for which purpose an apparatus is proposed, similar to that shown in our Plate.

The explanation of this apparatus is by no means clear in the specification, but if we understand the patentee's intention, the operation is as follows:—The vapour from the still passes from the pipe *a*, into a chamber *b*, from whence it ascends through the perpendicular tube *c*, and there descends again through the pipes *d d*, into the chamber *e e*, which is separated from the chamber *b*, by a flat plate; in this flat plate there are two or more bent pipes, through which the condensed part of the vapour flows into the chamber below, and by the form of these pipes the liquor is

enabled to run through, but not the vapour or air to ascend, as the liquor in passing forms a sort of hydraulic valve in the bend. The vapour proceeds from the chamber *e*, through the pipe *f*, into the second receiving vessel, from whence it ascends by very contracted passages *g g g*, into the upper chamber *h*, and thence through the pipe *i*, to the worm of the condenser. These passages are formed by a series of concentric cylinders one within the other, and the passages are not to exceed half an inch in width.

The peculiar feature of this apparatus is, that the whole of the chambers and pipes are immersed in hot baths; that is, they are inclosed in water-tight vessels, and surrounded with hot water. The temperature of the water in the first vessel is to be as high as 170 Fahrenheit; that of the second vessel lower. In order to expose the vapour as much as possible to the heat of the bath, the pipes *d d*, are proposed to be formed as flat ovals, and the passages *g g g*, may be either separated by zig-zag partitions, so as to retard the progress of the vapour, or the passages may be made to run round the cylinders as worms.

The hot water is made to surround the passages of the concentric cylinders by flowing from the top part of the second vessels through the pipes *j j*, and also through similar pipes below. The apparatus is proposed to be made of copper tinned, but no dimensions need be named, as they would depend upon the capacity of the still and condensing apparatus to which it may be attached.

BIOGRAPHY OF DR. CLARKE.

The Reverend Edward Daniel Clarke, D.D., is better known to the literary world by the eloquent and diffuse, but not correct accounts he published of the countries he visited than by his chemical researches. If we do not mistake, his Travels fill eight huge quarto volumes, and comprise a description of all Europe to the north of the Elbe, of the greater part of the Russian empire, of Turkey, Greece, and the Holy Land. To Cambridge-men, however, he was chiefly known as the eloquent and zealous teacher of mineralogy in that university.—The chemist is indebted to him for many researches with the blow-pipe, and for some interesting discoveries. It is in this latter character that we give him a place in our pages; as a traveller, we should leave him to the geographer and classical scholar, both of whom he led astray by the boldness of his conjectures, whenever they wanted either learning or ingenuity to question his assertions. As a teacher of mineralogy, understanding by that a man who describes the appearance and localities of stones, if his scholars recollected him, we should think him sufficiently honoured; but as a successful experimenter with the blow-pipe, the CHEMIST cannot pass him by unnoticed and unhonoured. The following short account of him we have abridged from a biographical sketch in the Annals of Philosophy for December. It was our wont to present our readers with an Analysis of that and other Scientific Journals; but their contents are in general so uninteresting, that we were obliged to seek for more amusing matter. To show our readers that Dr. Clarke is not unworthy of their notice, we shall prefix to the sketch taken from the Annals, a short account of his experiments, derived from another source.

Dr. Clarke was the first person who ventured to experiment largely with the oxyhydrogen blow-pipe, and he used it in 1817-1818, before those contrivances were adopted which now render it comparatively safe. Sir Humphry Davy had previously discovered that flame was not communicated through very small apertures; and Mr. Children had proposed the employment of a mixture of oxygen and hydrogen to produce an intense heat; but it was Dr. Clarke who first

acted on these suggestions to any extent, and whose intrepidity was rewarded with some very brilliant discoveries. He fused platinum with ease, and in the astonishing quantity of half an ounce at once. In smaller quantities he found that it burnt like iron wire. Before his instrument palladium melted like lead, and pure lime became a yellow wax-like vitrification, its fusion being accompanied by a lambent purple flame. Magnesia, strontites, silex, and alumina, were all successively fused; and the alkalies were volatilized with an evident combustion. Some of the most refractory minerals known, melted like glass. Gold exposed on pipe-clay to the flame was surrounded with a halo of a lively rose colour, and soon volatilized. Dr. Clarke fused a meteoric stone, and converted it into iron. From some of his experiments, he concluded that he had reduced barytes to the metallic state, and collected its base, barium; but subsequent experiments have thrown a doubt on this conclusion, and it is now thought that the globules he took for barium owed their lustre and polish to the fusion of the earth. All these experiments, and many other similar ones, Dr. Clarke performed before the blow-pipe was rendered, as it now is, a safe instrument; and though he interposed a screen betwixt himself and it, he always operated in considerable danger. The same cast of mind we think may be traced both in his experiments and in his writings. He is fearless and bold, but he is neither precise nor correct; and we accordingly find men of much less comprehensive understanding, who would never have adventured with his daring, nor could ever possibly have made his discoveries, have been enabled to detect his errors, and have in some measure gained reputation by his carelessness. He was unquestionably one of the most daring, if not the most ingenious of modern experimenters; and chemistry owes a great deal to his example of intrepidity. He died in March 1822, and having shown our chemical readers that his memory is deserving their respect, we shall proceed to present them with an outline of his life:—

He was born June 5, 1769, at Willingdon, in the county of Sussex, and was descended from a line of ancestors, whose learning and abilities reflected, for a long series of years, the highest credit upon the literature of their country. The celebrated Dr. William Wotton was his great-grandfather. His grandfather, "mild William Clarke," was one of the most accomplished scholars of his age; and his father, the Rev. Edward Clarke, was distinguished in the same honourable career. He is represented to have been from his infancy a most amusing and attractive child; and particularly to have exhibited, in the narrow sphere of his father's parish, the same talent for playful conversation and narrative, which ever afterwards distinguished him in the various and extensive circles through which he moved. He showed, when very young, a decided inclination to those objects of science which were the favourite studies of his later years. Having received the rudiments of his education at Uckfield, a small town within his father's parish of Buxted, under Mr. Gerison, who had been his grandfather's curate and his father's preceptor, he was removed, when somewhat more than ten years old, to the grammar-school of Tunbridge, at that time conducted by Dr. Vicesimus Knox. But his progress here was not very satisfactory: his attention appears to have been engrossed by various attractive subjects, some of a scientific nature, which were altogether inimical to his progress in classical literature. In the year 1786, when only sixteen years of age, he obtained, through the kindness of Dr. Beadon, then Master of Jesus College, the situation of Chapel Clerk in that Society.

About the end of the year 1789, he took his degree of Bachelor of

Arts, and within a few months afterwards, through Dr. Beadon's recommendation, he became the tutor of the Hon. Henry Tufton, with whom he made the tour of Great Britain in the summer of 1791. This was undoubtedly a most important epoch in Mr. Clarke's life; and it was the first opportunity he had of gratifying a passion which was always uppermost in his mind, but which he had hitherto been unable to indulge; and it necessarily threw in his way many opportunities of acquiring information in those branches of natural history for which he had early shown a decided taste, and to which he afterwards owed so much of his celebrity.

In October 1791, Mr. Tufton's brother being about to join Lord Thanet in Paris, Mr. Clarke and his pupil seized the opportunity of passing over with him to Calais, and thus he who afterwards traversed so large a portion of the globe, first set his foot on foreign ground; a circumstance which imparted to his ardent mind the most delightful sensations. In the spring of the year 1792, his engagement with Mr. Tufton terminated; and Lord Berwick, who had been of the same year with him in College, and was now of age, proposed that Mr. Clarke should accompany him, in the capacity of a friend, to Italy. This proposal was soon agreed to, and about the middle of July they set out, and took the route of the Low Countries to Cologne, and then ascending the Rhine to Schaffhausen, passed through Switzerland, by the way of Lucerne and St. Gothard, to Turin.

To a mind like that possessed by the subject of this memoir, panting for foreign climes, and glowing with all the warmth of poetic imagery, it was no small achievement to have thus passed the barrier of the Alps, and to tread in the paths which had been hallowed in his eyes by the footsteps of Addison and Gray. But this was only a part of his enjoyment while on this tour. The country which he had entered abounded in scenes and objects calculated, above all others, to awaken every pleasing association connected with his early studies, and to gratify his prevailing taste. The precious remains of antiquity dispersed throughout Italy, the fine specimens of modern art, the living wonders of nature, of which even the descriptions he had read, or the faint resemblances he had seen, had been sufficient to kindle his enthusiasm, were now placed before his eyes, and submitted to his contemplation and inquiry; nor were the springs and resources of his own mind unequal to the excitement which was thus powerfully acting upon them. At no period, even of his subsequent life, does he seem to have exerted himself with more spirit, or with better effect. He made large and valuable additions to his stock of historical knowledge, both ancient and modern. He applied himself so effectually to the French and Italian languages, as to be able in a short time to converse fluently, and to obtain all the advantages of acquirement and information in both; and, what was less to be expected, by dint of constant and persevering references to those classical authors, whose writings have contributed, either directly or indirectly, to illustrate the scenery or the antiquities of Italy, he made greater advances in Greek and Latin than he had done before, during the whole period of his education. He studied with great attention the history and progress of the arts, and, more particularly, of the different schools of painting in Italy; reading carefully the best authors, conversing frequently with the most intelligent natives, and then, with all the advantage of his own good taste and discernment, comparing the results of his inquiries with those of his own actual observation.

Nor was his attention less powerfully attracted towards those rich treasures of natural history, which the peculiar resources of the country, or the industry of collectors daily presented to him. Ve-

suvius, with all its various phenomena and productions, was his particular study and delight. He was the historian and the guide of the mountain, to every intelligent and distinguished Englishman who came to Naples during his stay; and connecting, as he did, a considerable degree of science and philosophy with all the accurate local knowledge, and more than the spirit and adroitness of the most experienced of the native guides, his assistance was as eagerly sought after as it was highly appreciated by his countrymen. He made a large collection of vases and medals, many of which have since found their way into different cabinets of Europe; and besides numerous valuable additions which he made to his own specimens of minerals, he formed several complete collections of Italian marbles and volcanic products for his friends. With his own hands he constructed models of the most remarkable temples and other interesting objects of art or nature in Italy; and one particularly of Vesuvius, upon a great scale, of the materials of the mountain, with such accuracy of outline and justness of proportion, that Sir William Hamilton pronounced it to be the best ever produced of the kind, either by foreigner or native; it is now at Lord Berwick's seat at Attingham, in Shropshire. These things he did, and much more, within an interrupted space of two years, during which, as it appears from his journal, so many of his hours were placed by his own good nature at the disposal of his countrymen in their literary or philosophical inquiries, so many others were dedicated as a matter of duty to Lord Berwick and his concerns, and so many more were devoted to the pleasures of society, and to those active amusements which our countrymen usually assemble round them whenever they take up their abode together, and for which the fine climate of Italy is so well adapted, that it must be a matter of surprise to learn, that he was able to do so much for himself. Nor will this surprise be lessened, when it is known, that besides his journal, he left behind him a great number of manuscripts connected with this tour, including some maps of his own construction.

He returned to England with Lord Berwick in June 1794, and in the autumn of that year undertook the charge of Mr. Mostyn, but remained in this employment only a year. In 1796, he distinguished himself by writing a pamphlet to serve an electioneering purpose, for his friend Lord Berwick. In the same year he commenced a periodical work, entitled "*Le Reveur*, or the Waking Visions of an Absent Man," which was not successful, and is now quite forgotten; it was continued for six months. In 1797, he became connected with the Uxbridge family, and accompanied one of its members in a tour through Scotland. In 1798, Mr. Cripps, a young man who had succeeded to a considerable fortune, but whose education had been neglected, placed himself under Dr., then Mr. Clarke's care, with the laudable desire of remedying the omissions of his friends. With this gentleman, a Mr. Otter, and the since celebrated Mr. Malthus, Mr. Clarke, in 1799, commenced those extensive travels to which we have already alluded. They landed, we believe, at Hamburgh, and visited Holstein, Norway, and Sweden. Mr. Malthus and Mr. Ottey then returned, and Mr. Clarke and his pupil continued their journey through Russia, Turkey, and the countries of the East, for the long period of three years and a half. They returned to England in the latter end of November 1802. The treasures they brought were numerous, and the academic honours they received, in proportion to the presents they made; but we postpone our brief notice of this part of Dr. Clarke's life to another Number.

(*To be continued.*)

TO BLEACH SPONGE.

Soak it in cold water, change the water every three or four hours,

pressing the sponge, at every change, quite dry; and, at the end of five or six days, it will be clean and soft, and fit for bleaching. If it is immersed in hot water, it will become hard, and be destroyed. If it contain small pieces of stone, immerse it in muriatic acid, diluted with 20 parts of water: a slight effervescence ensues, carbonic acid is given out, and the calcareous stones destroyed. It must be carefully washed after this operation. The sponge is then to be immersed in sulphurous acid of the specific gravity of 1.024., and kept immersed for a week, being several times during this period taken out and subjected to heavy pressure. It is afterwards allowed to remain 24 hours in running water. After being sufficiently washed, it is scented with rose-water, or orange flower-water, and allowed to dry in the air. It is then, and not before, fit for a lady's bath, or a lady's toilet.

DICTIONARY OF CHEMISTRY.

Derbyshire Spar, *fluate of lime, fluoride of calcium.* A well-known and rather beautiful mineral. It is principally a compound of calcareous earth and fluoric acid; or, according to Sir Humphry Davy's opinion, of *fluorine* and *calcium*.

Dessication. Abstracting moisture from bodies, so as to make them perfectly dry. One of the best means of accomplishing it is to place them in the receiver of an air-pump with some substance like sulphuric acid, that has a strong affinity for water, and exhausting the receiver.

Detonation. Properly, a loud noise, with sudden combustion, expansion, and condensation.

Deut-oxides. *Deut* is the first syllable of the Greek ordinal numeral, corresponding to *second*, and the first syllable of these numerals having been applied to designate the different *oxides*, *chlorides*, &c. &c., *deut-oxides* are the second oxides of any substance. Thus, the deut-oxide of lead is this metal combined with a proportion of oxygen the next greater to the least proportion with which we know it to be combined.

Dew. The moisture deposited in the evening and night on the surface of the earth in clear weather. It seems to depend principally on the heat-radiating power of bodies, by which they become colder than the atmosphere, and condense on themselves its moisture. Hence different bodies, possessing different radiating powers, are covered, when exposed to the same sky, with different quantities of dew.

Diallage, *smaragdite, verde di Corsica, duro, gabbro.* A mineral of a grass-green colour, employed for ornamental jewellery. It is found in Corsica and Switzerland, and consists of silica 50, alumina 11, magnesia 6, lime 13, oxide of iron 5.3, oxide of copper 1.5, oxide of chromium 7.5.

Diamond, *carbon.* A well-known precious stone. Some of the most laborious and ingenious chemical experiments ever undertaken, in which some of the most illustrious chemists of the day have participated, seem to have demonstrated, *chemically* speaking, that *diamond* and pure charcoal are the same substance. The only difference detected between them is, that charcoal contains a small quantity of hydrogen, but so very minute, amounting only to 1-50,000th part of the weight of the substance, that it cannot influence its characteristics. The difference in the appearance of the two substances is attributed to crystallization, or some peculiar *arrangement* in the particles of the carbon in the different substances. As in almost every year some before-unknown substance is detected, we would rather say, that the *chemical* resemblance arises from the imperfection of our tests, than that the two substances are the same. The latter assertion is such a violation of common language, that we hesitate in agreeing to it. *Sameness* invariably signifies similarity, or identity of sensible properties; and whenever *sensible properties* are different, there is good reason to believe that the

elements are different: All our classifications, both those rude ones which serve for common purposes, and those more refined ones which are the bases of scientific description, ultimately rest on a difference or similarity of sensible properties; and we should get into inextricable confusion were we to apply the term *same* to two substances so essentially different in their sensible properties as *diamond* and *charcoal*, because their *products*, when burnt with oxygen, are the *same*. It is, however, unquestionably a very curious fact, that the most refined and powerful analysis can detect no chemical difference between the *diamond* and *charcoal*.

Digester. An instrument invented by M. Papin, and intended to subject bodies to heat under a considerable degree of pressure, and thus increase its effects. It is a strong iron or copper vessel, with a valve which may be more or less loaded.

Digestion is the slow action of a solvent on any substance; and it is an animal function by which food is converted into nourishment.

ANTIDOTE FOR SULPHURIC ACID.

It very often happens that the sulphuric acid, or *oil of vitriol*, or *vitriolic acid*, as it is called, is swallowed, either by accident or design. It is a virulent poison, producing instant inflammation, and speedily destroying the coats of the stomach, the lining of the throat, and every other part of the body with which it comes into contact. Help, in such cases, to be efficacious must be instant. It has been proved by the experiments of Orfila, that the best remedies are of no use, if not speedily administered, for the rapidity with which the acid eats the body into ulcers is terrific. A little knowledge, then, of the means of administering an antidote in such cases, is of far more value than a physician living at a short distance. The instant that such a substance is swallowed, and we wish to counteract its effects, we must *gorge* the patient with magnesia, suspended in water. This earth is the best known remedy. It should be calcined, or pure magnesia, as the common magnesia, or carbonate of magnesia, produces great inconvenience, from the carbonic acid gas it generates. If there is neither calcined nor common magnesia at hand, make the patient drink soap suds, or water in which soap is dissolved. If this is not to be got at, give milk; and in the absence of every thing else, give large quantities of warm or cold water. The acid itself produces excessive vomiting; and it therefore requires a great effort on the part of the patient to swallow any thing. He must therefore be encouraged, by a hope of cure, to exert himself, and aid the physician. If we do this, and happen to have magnesia at hand, or can supply its place, till it be procured, with soap and water, we may chance to save even those who have taken a dram or a draught of sulphuric acid.

ANOTHER FRIGORIFIC MIXTURE.

It is already known, that in rubbing together the two solid amalgams of lead and bismuth, they become liquid. Lately, M. Ozioli, of Boulogne, found that if the bulb of a thermometer was employed to make the mixture, the mercury fell 22° of Reaumur during the liquefaction. He attributes this great degree of cold, and the rapidity of its production, to the conducting power of the metallic substances employed. — *Bulletin des Sciences Technologiques.*

COMBUSTION OF COPPER AND SULPHUR.

To the Editor of the Chemist.

Mr. Editor,—You are no doubt aware that three parts by weight of flowers of sulphur and eight of copper filings, mixed well together, and exposed in a test tube over a lamp furnace, will exhibit a brilliant combustion, *though the access of atmospheric air be excluded;* and

that various theories have been proposed to account for this phenomenon, which seem inconsistent with the present theory of combustion, as the combination takes place without the presence of oxygen.

Is it impossible that sulphur is the oxide of a metal hitherto unknown? and that some portion of its oxygen, sufficient to support combustion, is liberated for that purpose in the experiment alluded to? *

Nov. 29. SPECULATOR.

* We readily insert this communication, because, knowing that writing is one of the best means of giving precision to thought, we wish to encourage our Correspondents to communicate their speculations, and because we shall have a better opportunity of making "Speculator" aware of some facts that ought to guide his opinion in the present case. We must firt observe, that the theory of *oxygen* being necessary to *combustion* is no longer held by any very distinguished chemist; and it is now generally supposed that combustion, or the emission of light and heat, may take place whenever any *intense chemical* action ensues, whether or not oxygen be one of the substances acted on. It is therefore hardly worth while to speculate with a view of upholding a theory which is opposed by many other facts, besides the combustion produced by copper and sulphur. When this compound is made in atmospheric air, or in oxygen, it also combines with oxygen, (Thompson's System;) but when made in any other gas, the compound presents no traces of oxygen. There is no reason, therefore, to believe that the sulphur supplies any. Mr. Brande states, however, that during the union of the copper and sulphur, *hydrogen* is always liberated. He also states, that whenever sulphur is exposed to the action of Voltaic electricity, hydrogen is liberated; whence there is reason to believe that *sulphur* is a compound. Our Correspondent may therefore be right in part of his conjecture; but admitting that sulphur is a compound, we have no reason except that which is derived from the theory above alluded to, for believing that oxygen is one of the elements. "Speculator" will perhaps make the experiment in an exhausted receiver, and then try if he can procure any oxygen from the compound.

QUERIES.

Is there any practicable and cheap method by which the tannin can be extracted from oak bark, for the use of tanners, so as to render the transport of the bark itself unnecessary?

Can such extract be manufactured best and cheapest in a dry state or as a liquid?

The above questions are asked by a person who has a great quantity of bark, the local circumstances of which are such that it cannot be profitably made use of, but which, if reduced to an extract, either dry or liquid, might be sent to a market, provided such extract could be used with advantage by tanners.

The way to make fumigating pastils?

TO CORRESPONDENTS.

We are obliged to postpone "Observator's" second communication to a future Number.

We are sorry we are not at present able to give our "Constant Reader" the information she requires, but we have inserted her query.

If "A Young Reader" looks at p. 120, vol. i. he will find a ready method of making one species of an electrical machine; we cannot tell him the *cheapest* mode of constructing a regular electrical machine, and should imagine he will find it cheaper to buy than to make. A Leyden phial is merely a large glass jar, coated with tin foil, and having a discharging knob. He will find, in our present Number, a cheap mode of constructing one.

J. G—n should dissolve *speiss* in sulphuric acid, adding as much nitric acid as will complete the solution. If this solution be concentrated by boiling, and then set aside, it will deposit, after a time, fine green crystals, which are sulphate of nickel. When, by this process, repeated if necessary, a sufficient quantity of crystals are obtained, dissolve them in water, and crystallize a second time. Again, dissolve them in water, and add an alkali, when pure oxide of nickel will be precipitated. Mix it with 3 per cent of resin, make it into a paste with oil, and expose it to the most violent heat of a forge in a charcoal crucible. Pure nickel will then be obtained. We are afraid our Correspondent will find this neither an expeditious nor a cheap method, but it is the best we are acquainted with.

We shall, in our next, give a part of "Tyro-Chemicus'" other letter.

⁎ Communications (post paid) to be addressed to the Editor at the Publishers'.

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The Chemist.

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Fig 1

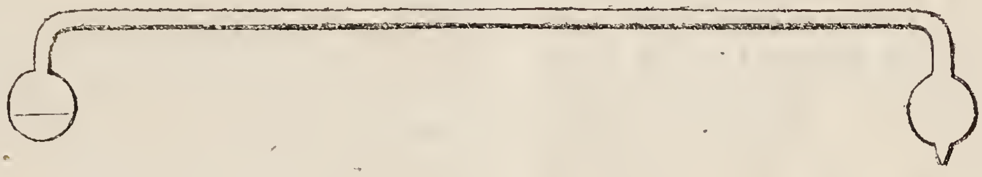
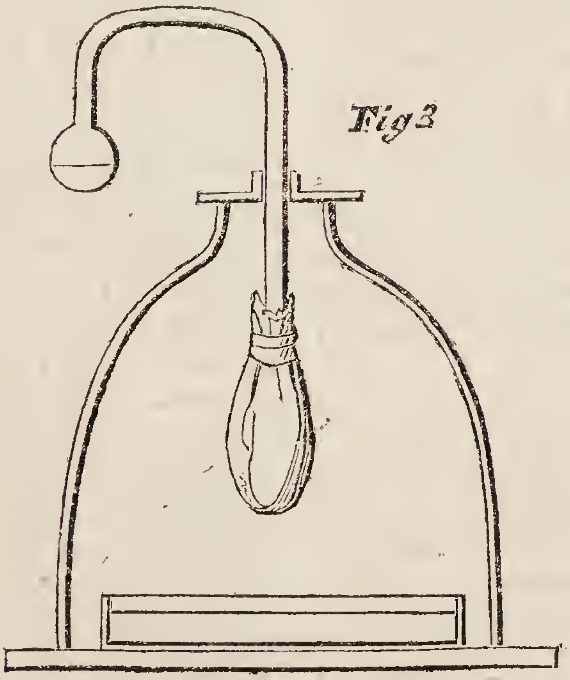


Fig 2

Fig 3



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DR. MARCET'S APPLICATION OF DR. WOLLASTON'S CRYOPHORUS.

In Mr. Brande's Lecture, reported in our No. XXXIII., p. 75, Dr. Wollaston's cryophorus, or frost bearer, is mentioned; and of that instrument, with Dr. Marcet's application of it, we now present our readers with a copy. It is a glass tube, (Fig. 1.) with a bulb at each end, one of which contains a small quantity of water, and from which the air has been completely exhausted. The water in the bulb is therefore much disposed to pass into vapour, and vapour actually fills the tube. If the bulb containing only vapour be cooled, so as to condense the vapour, the evaporation which ensues from the water is sufficient to freeze it. Dr. Marcet recommended the use of a cryophorus of the shape seen in Fig. 3, because the elongated bulb passes easily through the brass plate which closes the top of the receiver. Now, as ether in evaporating produces an intense degree of cold, if we inclose this bulb in a little flannel bag, (Fig. 2.) soak it in ether, and introduce it into the receiver of an air-pump, (Fig. 3.) and then exhaust the receiver quickly, in less than a minute the water in the other bulb will freeze. It is a very curious experiment, as showing distinctly the manner in which ice forms in crystals.

LECTURES AT THE ROYAL INSTITUTION.

OXYGEN. NOMENCLATURE. THEORY OF COMBUSTION.

Lecture 15. Mr. Brande began by remarking, that the object of the lectures hitherto delivered had been to make his hearers acquainted with the powers and agents which are active in producing chemical changes; and we now come to what is properly the business of the course—to examine the different bodies and substances on which these agents or powers exert their energies. All these substances are first divided into simple and compound, and the former again into such as are electro-negative, and such as are electro-positive. By these terms it is meant that certain bodies are strongly attracted by the positive end of the galvanic pile, and others by the negative end; it is therefore concluded that the natural state of the former class of these bodies is electro-negative, and of the latter electro-positive. The electro-negative bodies have been also called supporters of combustion, from an idea having been entertained, and a theory formed, that the presence of one of them was necessary in all cases of combustion. As this theory is now given up, the name has ceased to be proper. They have also been called acidifiable bases, on the supposition that they were the bases of all bodies having acid properties. But some bodies have been discovered possessing acid properties, in which we cannot trace the existence of the acidifiable bases, and this appellation is therefore not more appropriate than the former.

Of the electro-negative bodies of which I shall first treat, there are only three: oxygen, iodine, and chlorine. The name of the first is a Greek word, signifying generator of acids. It is found, indeed, that this is not a correct application, but it has been thought better to retain the word than substitute another that involves no erroneous theory. Chlorine is also a Greek word, applied to this substance on account of its colour, which is a greenish-yellow. Iodine is also named from its colour, which is violet. Thus the latter terms involve no theories, and are characteristic of at least one sensible property of the substance. Before proceeding further, I may lay before you the principles on which the compounds of these bodies and of other substances are named. The combinations of the electro-negative substances with other bodies are divided into two classes—those which possess acid properties, and those which do not. To the latter, the termination *ide* is applied, and

we have thus oxides, chlorides, and iodides; as, for example, the oxide of chlorine, consisting of oxygen and chlorine.* But these elements may combine with each other, or with other substances, in more than one proportion, the compounds not possessing acid properties; as, for example, the combinations of oxygen and the metals, forming several oxides. Now to distinguish them, we call to our help the first syllable of the Greek *ordinal* numbers. Speaking then of the first oxide of lead, or that which contains the least oxygen, we call it the *proto*-oxide; the second oxide, or that which contains a greater proportion of oxygen, is called the *deut*-oxide; that which contains a still greater proportion, the *trit*-oxide; while that which contains the largest possible quantity of oxygen, is called the *per*-oxide. In general we are acquainted with only one or two oxides of the different bodies, though there are sometimes three, and that which contains the largest quantity of oxygen is always denominated the *per*-oxide. We proceed in the same manner, in naming the compounds of other substances, with chlorine and with iodine, excepting however for the former oxygen, and for the latter both oxygen and chlorine, their compounds with iodine being called oxides and chlorides, and not iodides.

For the nomenclature of the compounds of these bodies, which possess acid properties, we take the name of the base of the compound for the generic term, and add to it the syllables *ous* and *ic*, prefixing the term *hypo*, to distinguish intermediate acids, or those containing a less quantity of acid than the next above it. The combinations of sulphur, for example, with oxygen forming acids, are thus designated:—First, there is the *hypo*-sulphur*ous*, or an acid containing less oxygen than the second, which is the sulphur*ous;* and then we have the *hypo*-sulphur*ic*, which contains less oxygen than the sulphuric: *ous*, it will be remarked, being the termination given to the acid with least oxygen, and *ic* to that with most.* We have indeed an example of these same terminations applied to oxides, as the *nitrous* and the *nitric* oxides—two combinations of oxygen with nitrogen. In naming the secondary compounds, or those of the acids and the oxides, if the compound be formed of the acid which contains a minimum of oxygen, we apply *ite;* if the acid contain the maximum of oxygen, we apply the syllable *ate;* thus *ous* makes *ite*, and ic *ate*. For example, sulphurous acid, combined with potassa, makes *sulphite* of potassa; sulphuric acid and potassa make *sulphate* of potassa. If the combination be between an acid and an oxide of a metal having more than one, to distinguish which of them is combined with the acid, the ordinal Greek numbers prefixed to the oxide are employed. Thus we have *proto-sulphate* and *persulphate* of iron; the first signifying the combination of sulphuric acid with the prot-oxide, and the latter its combination with the per-oxide of iron. The compounds of the electro-positive substances with each other are distinguished by the addition of the termination *uret*, as *sulphuret* of phosphorus, *phosphuret* of carbon, and *carburet* of iron; and as they also may combine in more than one proportion, the syllable *bi* is prefixed to such of their combinations as contain twice the quantity of the substance which is supposed to modify, or is the adjective of the other. Thus, *bi-sulphuret* of phos-

* We do not know on what principle this is called an oxide rather than a chloride, but we believe from oxygen having been first put in possession of the termination. The reader will easily remark that the terminations of the root words *ygen* and *ine* are omitted; simply because it makes the compound word less cumbrous, and the first syllable answers all the purposes of distinction.

* Probably, what is now called the hypo-sulphurous acid, would not have been so named, but in consequence of the term sulphurous having been appropriated before it was known.

phorus signifies a combination of phosphorus and sulphur, containing twice the quantity of sulphur which the sulphuret contains.

After giving this outline of the principles of chemical nomenclature, the Professor went on to describe the apparatus for experimenting on gaseous bodies, and on the modes of procuring oxygen, which subjects having already been treated of in The Chemist, and the Professor having stated nothing new concerning them, we do not think it necessary to follow him at length. The oxygen gas he procured by the ordinary methods of heating chlorate of potassa and black oxide of manganese; of the former he remarked, that it was seldom used, on account of its expense, unless very pure oxygen was wanted. In using the latter, it is necessary to dry it carefully before putting it into the retort; for it sometimes contains a considerable quantity of water, and when it came over as steam, was condensed by the cold water of the pneumatic trough, which was apt to flow into the retort, and cause mischief, sometimes exploding it. Sometimes also the manganese is sold after it has been used to obtain oxygen, when of course no more can be extracted from it. Sometimes, too, it is mixed with common salt or charcoal, and then the product is not oxygen but carbonic acid. It is necessary therefore to try this substance before using it; and when dry and pure, the oxygen obtained from it is sufficient for all practical purposes.

In speaking of the specific gravity of this gas, the Professor said it was necessary to consider its absolute weight, its weight as compared to air, and its weight as compared to hydrogen. In the former relation, 100 cubic inches weigh 33.88 grains; in the second, assuming air to be 1000, oxygen was as 1-1232, being heavier than air; in relation to hydrogen, assuming the latter to be one, it was as 16. When first discovered by Dr. Priestley, in 1774, this gas had attracted great attention, because till then no gas had been discovered which was not instantly fatal to animals. From animals living in it a longer time than in air, he concluded it was even better adapted for respiration; but on breathing it for a length of time, hurried respiration ensues, and at length inflammation supervenes, and the animals die. This opinion of his was therefore an error, atmospheric air being better adapted for respiration than oxygen gas.

The Professor then performed several of the common experiments of burning substances in oxygen, and mentioned that Dr. Ingenhouze was the first person to exhibit the combustion of iron in oxygen. This experiment succeeded instantly with Mr. Brande; but we noticed a few evenings before at the Mechanics' Institution, that it failed in the hands of Mr. Cooper.* The fused iron was fixed in drops to the plate, and the glass appeared as if cracked. Mr. Brande explained that it had been cracked before, and that it was proper to use a cracked jar for making the experiment. The lecture was concluded by the following outline of the history of the various theories of combustion.

After the discovery of oxygen, it was supposed by Lavoisier and his associates, that oxygen was the universal supporter of combustion; and, according to this, which has been denominated the French theory, it was supposed that ox-

* We must take the liberty of remarking, that all Mr. Brande's experiments are neat and successful; but he has the great advantage of lecturing in his own laboratory, as it were, and has the ablest assistant, probably, of any man in Europe, Mr. Faraday. It is impossible to attend his lectures, and those given at the Mechanics' Institution, without observing the difference in the experiments. We attribute this entirely to the laboratory and assistant; and would therefore suggest to the consideration of the Committee of the Mechanics' Institution, whether, if they contemplate making chemistry a permanent branch of instruction, it will not be advisable in their new building to construct a laboratory, and provide a regular and skilful chemical assistant.

ygen was always present in every case of combustion, and that the light and heat evolved was owing to the condensation of the gas with the ponderable combustible. The heat and light was supposed at first to be furnished by the oxygen, but it was soon remarked that the light depended on the nature of the combustible, and was different, both in colour and intensity, in almost every different case of combustion. Phosphorus also condenses much less oxygen in its combustion than when an equal quantity of sulphur is burned, and yet the light is much more vivid and intense. The theory was then modified; and it was supposed that the combustible furnished the light, and the oxygen the heat. But to this modification of the theory it has also been objected, that there are many cases of combustion in which oxygen, so far from becoming solid, is set at liberty, from its union with a solid, and the products of the combustion are gases. But what is an insuperable objection to this theory is the fact, that there are numerous cases of combustion, in which the presence of no oxygen whatever can be traced; such, for example, as when copper burns in the vapour of sulphur. The Lavoisierian theory is therefore no longer tenable; and it would appear that we cannot attribute the power of supporting combustion to any peculiar substance, but it must be considered as a general result of intense chemical action.

It is however worthy of remark, that a French physician of the name of Rey proposed a theory similar to that of Lavoisier's, as early as 1630. He concluded, as Lavoisier afterwards did, from metals increasing in weight by the action of heat, that this arose from the fixation of air. Boyle, not very long after this period, by making experiments on bodies burning in the exhausted receiver of an air pump, ascertained that combustion did not take place unless air was present; and Hooke anticipated the modern discovery of oxygen being the great agent in ordinary cases of combustion. It was his opinion, that combustion was owing to the presence of atmospheric air, which he described as the dissolvent of all inflammable bodies; and, what is more remarkable, said, that this dissolving power of the air is owing to a substance being mixed with it, which is also mixed with or found in saltpetre. This substance Hooke called the nitro-aërial substance; and oxygen does exist in great quantity in saltpetre, though it was not experimentally demonstrated till long afterwards. Hooke anticipated, by something more than a fortunate conjecture, one of the modern discoveries which has most contributed to the advancement of chemical knowledge. His nitro-aërial substance and oxygen are the same. These views are detailed in his Lampas, published in 1677. In 1674, Mayow, another Englishman, published his Tracts on various chemical subjects, in which he carried the matter one step further, and proved, that in combustion a portion of the air is consumed or destroyed. All these circumstances taken together constitute a theory of combustion, which is identical with that of Lavoisier. But while the chemists here were at work in establishing a theory of combustion by experiment and careful inference, Beccher and Stahl, in Germany, were raising a whole system on a bold hypothesis, which happening to fall in with many received opinions, and pretending to account for all the phenomena, thus relieving the mind from the fatigue of inquiry, became very generally adopted on the Continent, and was probably the cause why the discoveries of Hooke and Mayow were so long overlooked, or at least were not followed out. In 1669, Beccher published his theory, and attributed the phenomena of combustion or fire to a peculiar principle, which he called phlogiston. According to this theory, metallic lead, when melted, lost phlogiston, and became converted into an

earth. It was not by absorbing a substance, as other philosophers had supposed, but by giving out phlogiston, that the metal was converted into an earthy substance, and the metallic qualities of lead and other metals depended on phlogiston. On the same principle, charcoal was described as a substance abounding in phlogiston; and when it was heated with the calces of the metals, they were again converted into metals. But the fact of the calx being heavier than the metal was against the supposition of its having lost phlogiston; this was, however, met by Beecher and Stahl, by saying, that phlogiston was endowed with a principle of absolute levity; that it had a tendency to fly off from the centre of the earth in straight lines, and that therefore the increase of weight was owing to a loss of levity. This theory remained, till the discoveries of Black and Priestley enabled Lavoisier to prove that it was unfounded, and to supersede it by a theory of his own. As I have already told you, this theory is no longer generally adopted; there is no peculiar substance endowed with the power of producing combustion; it sometimes takes place when solids act on each other, as well as when one of the substances is a gas; it takes place also when no oxygen is present, and must be considered as the result of intense chemical action between any two substances, and not as effected by the union of any one substance with all the others. It has indeed been more lately suggested that the phenomena of combustion may be connected with the electrical energies of bodies; and, in confirmation of this view, it has been remarked, that all those bodies which act most powerfully on each other are in an opposite electrical state. It has been thrown out as a question worthy of consideration, whether the production of light and heat in combustion is not occasioned by the annihilation of the opposite electricities of the combining substances, just as we see an intense light and heat, produced by bringing together the pieces of charcoal at the end of the wires attached to the opposite poles of the Voltaic battery, cause an annihilation of the opposite states of the electricity.*

DYEING.

To the Editor of the Chemist.

Sir,—In your 34th Number appears a communication from "Investigator" on the subject of Dyeing. Your correspondent states, that "after boiling some logwood a considerable time, he added a small portion of sulphate of alumina; but found that, immediately on its introduction, the logwood was precipitated, leaving but a slight tinge of blue in the liquor." Not being able to account for this, I determined to attempt its elucidation, by resorting to the experiment

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* We do not mean to laugh when we say, according to this supposition, the sun must be considered as a great Voltaic battery, or rather as the point where the two opposite states of electricity produced in all the planets of our system is annihilated. From all the facts which come within our knowledge, there seems reason to believe that the heat and light produced by the sun are precisely similar to terrestrial light and heat; whence the conclusion follows, if these are an annihilation of opposite electrical states, so must those be. On such a supposition, too, we see a cause for the perpetual light of the sun. The opposite states of electricity, for example, in the Voltaic battery, are perpetually re-excited and re-annihilated, if we may use the phrase; and so we may suppose the motions of the planets, or some other cause, perpetually re-exciting those opposite states of electricity, which are in the sun re-annihilated. On this supposition, too, we see how the sun may be, in spite of all its heat and flame, a very comfortable habitation. Animals which emit electricity are not hurt by it; and it does not follow, because here substances are consumed between the two poles of the Voltaic battery, by being in a different state of electricity, that the inhabitants of the sun should be in a similar electrical state. We know nothing, and can know nothing of all these things; but there does seem some reason to conclude, in whatever manner we may explain the phenomena of terrestrial combustion, that celestial combustion, or the light and heat of the sun, must be explained in the same way.

above described. I accordingly put a handful of Campeachy logwood into soft water; and, after allowing it to boil half an hour, added 1 oz. of Yorkshire alum, manufactured by Messrs. Mackintosh & Co. After ten minutes had elapsed, I removed the saucepan from the fire, and filled a wine-glass with the liquor, not doubting that I should find the precipitation complete. What, then, was my surprise, on observing that no precipitation had taken place! I then allowed it to stand all night, on the supposition that cooling might have some effect on it; but still the logwood was not separated, the liquor retaining its original deep colour, only a little bluer, from its having imbibed the oxygen of the atmosphere. I afterwards tried the experiment with hard water and Honduras logwood; but the result was still the same. In the latter case there was a trifling sediment at the bottom of the glass, proceeding, I should suppose, from the chalk and magnesia which the water contained.

Being rather perplexed at finding the result so contrary to my expectation, I resolved to pursue the inquiry a little further. The carbonates, both of potassia and soda, precipitated the logwood; and the acids, by overcoming the alkalis, " restored the coalition;" but, as your correspondent observes, " rendered the liquor too red for use." I then tried the effect of lime, on the admission of which chemical action immediately took place, and the logwood was precipitated. It might possibly happen, therefore, that the failure of Investigator's experiment was occasioned by the water which he employed being strongly impregnated with lime; considerable quantities of which, it is well known, are held in solution by hard water.

Should your correspondent at any time discover that his liquor is in a state of separation, he will find it advantageous to make use of spirits of chamberlye, which he may obtain from the archil makers; chamberlye being famed for raising logwood wherever it exists. I would also recommend him to employ Yorkshire alum, in preference to that manufactured in Scotland; the latter being of a coarser nature than the former.

Hoping that your correspondent may derive some benefit from the preceding observations,

I am, Mr. Editor,

Yours respectfully,

Nov. 29th. Οὐδεὶς.

ANECDOTE OF DR. PRIESTLEY.

Dr. Priestley's attention is said to have been first attracted to chemistry by living near a brewery. He there used to amuse himself by pouring vessels of water into the fermenting tun, and collecting in its place carbonic acid gas. With this he made a number of experiments; and, proceeding from one thing to another, was gradually led on to those numerous discoveries which will for ever endear his name to the lovers of science.

MR. BROWN'S PNEUMATIC ENGINE.

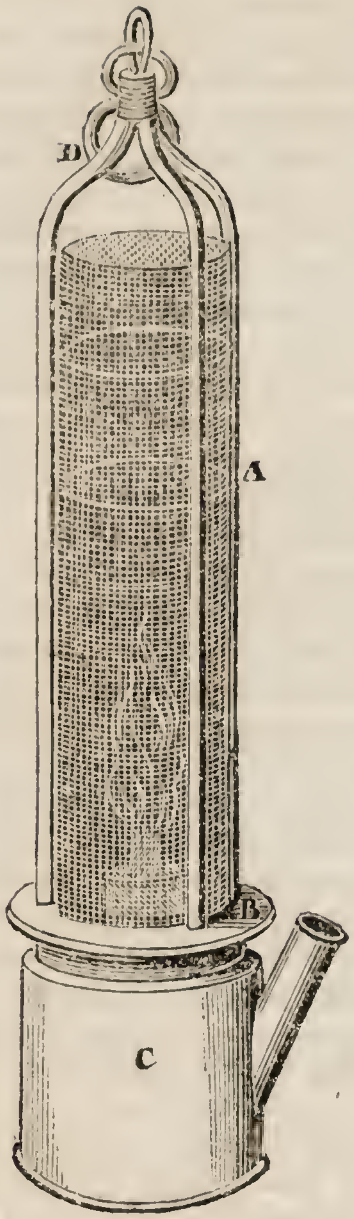
This gentleman's patent right has been purchased for Scotland on the following terms:—1000*l.* paid down when the agreement was signed, 4000*l.* to be paid when the deeds are executed, and security granted for 5000*l.* per annum for three years.

TEST FOR THE PURITY OF SULPHUR.

This substance is much employed in the arts, and a test for ascertaining its purity must be of service. When heated gradually on a piece of platinum leaf, if it be pure it will wholly evaporate; if not pure the contaminating matters will remain. Pure sulphur is also perfectly soluble in boiling oil of turpentine.

TO MAKE FIGURES IN AMBER.

Boil it in oil, when, from certain cracks in its interior, not seen on its surface, it appears to have within it a number of different objects. Such amber is more valuable than other.



SIR HUMPHRY DAVY'S SAFETY LAMP.

Mr Editor,—You have lately told us a good deal about Sir Humphry's safety lamp, but I for one did not understand how the gauze was applied till I met with the accompanying description of the instrument by Sir H. himself. Supposing, Sir, that many other of your readers may be as slow of comprehension as I am, I enclose you Sir H.'s drawing and description, trusting you will insert them, if they are only for the benefit of your country readers. I must observe, however, that on showing the drawing to a friend, he remarked that the one he had seen had not the ring and wire frame, recommended by Sir Humphry.

I am, Sir,

Your obedient servant,

John Slow.

London-wall, Dec. 6.

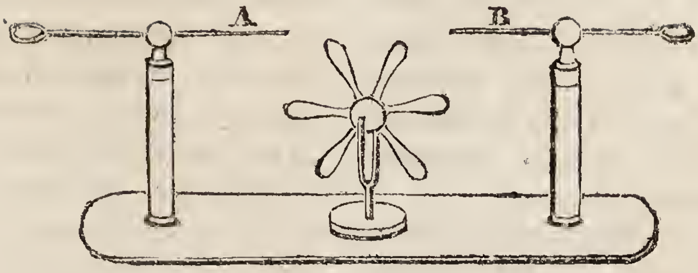
A is a cylinder of wire gauze, with a double top, securely and carefully fastened by doubling over to the brass rim B, which screws on to the lamp C. The whole is protected and rendered convenient for carrying by the frame and ring D. If the cylinder be of twilled wire gauze, the wire should be at least of the thickness of 1-40th of an inch, and of iron or copper, and 30 in the warp and 16 or 18 in the weft. If of plain wire gauze, the wire should not be less than 1-60th of an inch in thickness, and from 28 to 30 both warp and woof.—*Davy on the Safety Lamp, p.* 114.

MECHANICAL EFFECT OF ELECTRICITY.

The mechanical effects of electricity are exhibited in its power of impelling and dispersing light bodies, of perforating, expanding, compressing, tearing, and breaking to pieces, all conducting substances through which it is sufficiently powerful to force its passage.

If a light wheel, having its vanes made of card paper, be made to turn freely upon a centre, it will be put in motion when it is presented to an electrified point. The wheel will always move from the electrified point, whether its electricity is positive or negative. In this experiment, the current seems to be produced by the recession of the similarly electrified air in contact with the point; and therefore the circumstance of the wheel turning in the same direction when the electricity is negative, cannot, as Mr. Singer has remarked, be considered as any proof of the existence of a double current of the electric fluid. As an illustration take the following experiment:—

Place upon an insulating stem a light wheel of card paper, properly suspended upon pivots, as represented in our Plate, and introduce it between the pointed wires A B of the universal discharger, placed exactly opposite to each other, and at the distance of little more



than an inch from the upper vanes. Then having connected the wire A with the positive conductor, and the wire B with the negative conductor of an electrical machine, the little wheel will revolve in the direction A B; and if the wire B is connected with the positive end, and A with the negative end, the motion of the wheel will be from B to A. The transmission of a small charge through the wires, by an insulated jar, will produce the same effect.

The preceding experiment, imagined by Mr. Singer, is considered by him as a proof that there is only one electric fluid, and that it passes from the positive to the negative wire; for if there were two electric fluids, he concludes, "that the wheel being equally acted on by each, will obey neither, and remain stationary."

BIOGRAPHY OF DR. CLARKE.

(*Concluded from p.* 159.)

We continue our account of Dr. Clarke's Life, and must first state what were the presents he made to the University of Cambridge, and what were the honours he received. Mr. Clarke had sent to England more than seventy cases of his own before he left Constantinople, whilst his companion had upwards of eighty, obtained under his advice and influence; and considering the remoteness of the places from which they had most of them been dispatched, and the variety of conveyances to which they had been entrusted, so little had been sustained by them, either of loss or of injury, as to be matter of just congratulation to the collectors.

Of all these treasures, the first place in Mr. Clarke's mind was given to the Eleusinian statue of Ceres; and this, not only on account of the high distinction to which the statue was destined in the University, but for the rank he assigned to it, amongst the monuments of the purest age of Grecian sculpture, and the many classical associations connected with its history. By the liberality of government, it was allowed to be taken out of the custom-house duty free; and when at last a place had been assigned to it by the University authorities in conjunction with the donors, and the proper preparations had been made for its reception, it was securely placed upon its pedestal, with all due form and honours, in the most conspicuous part of the vestibule of the Public Library, on the 1st of July 1803; and the names of Dr. Clarke and Mr. Cripps were, by the desire of the University, inscribed upon the base. The public appearance of the statue was quickly followed by a tract from Mr. Clarke's pen, which naturally grew out of the transaction, and was indeed important to the illustration of it. In this work, which is entitled "Testimonies of different Authors, respecting the Colossal Statue of Ceres," the monument in question is clearly proved to be the very individual bust, described as lying at Eleusis, by Wheler and Spon, Pococke, Chandler, and others, and considered generally as the epresentation of the Goddess. In the winter of this year a grace was passed unanimously in the senate of the University, for conferring the degree of LL.D. upon Mr. Clarke, and that of M.A. upon Mr. Cripps; and to mark with

more distinction the sense of the University, in conferring these honours, a third grace was subsequently carried, to defray the whole expense of Dr. Clarke's degree from the University chest.

The next object connected with his travels to which he directed the public attention, was the celebrated Sarcophagus, now in the British Museum, captured from the French at Alexandria. It is well known how instrumental Dr. Clarke had been in discovering this noble monument of Egyptian art, when it had been clandestinely embarked for France, on board a hospital ship, in the port of Alexandria, and in rescuing it from the hands of General Menou, and the French Institute, who clung to it with a degree of obstinacy almost incredible: and it was very natural that the interest he had taken in it in Egypt should revive with its arrival in England; especially as the origin of the monument soon became the subject of much speculation and perplexity amongst the learned, and Dr. Clarke conceived himself to be possessed of evidence calculated to throw light upon it. Under this impression he drew up, in 1805, a Dissertation on the Sarcophagus in the British Museum, brought from Alexandria. It was inscribed to Lord Hutchinson, under whose authority he had acted in Alexandria, and the main object of it was to vindicate the pretensions of the monument to the title of the tomb of Alexander. To this hypothesis he had been first led by the name it bore (the tomb of Iscander,) amongst the most ancient race of the neighbouring inhabitants, coupled with the extreme veneration felt for it as such by the Turks and other persons of every description in the city of which this hero was the founder; and having been afterward partially confirmed in his opinion by the reports he found in the works of early travellers, as well as by the conversation of learned men on the Continent, and at last more decidedly by an accurate examination of such classical authors as had treated on the subject of Alexander's death and burial, he collected his proofs and arguments in a manuscript, which, after being handed about among his friends, in 1804, was by their advice published in the following year, under the title already mentioned. The work had been placed in the hands of Lord Hutchinson, with a view to its being printed by the Antiquarian Society, but was afterward withdrawn at the suggestion of his friends, who thought it would appear more expeditiously, as well as advantageously, from the University press, the managers of which undertook to print it.

The extraordinary activity of Dr. Clarke's mind enabled him, in the very midst of a controversy to which this publication gave rise, (Easter, 1805,) to compose and send to press "A Treatise on Mineralogy," principally intended for students, of which the following notice is given in a letter to Dr. Henley:—"I have already sent another work to the press, very different in its nature, which will be mere play to me this Easter vacation. It is 'an easy and simple method of arranging the substances of the mineral kingdom,' by which I hope to make mineralogists as fast as Bolton makes buttons. The introduction only is addressed to persons rather above the class of students, and is intended to develop the theory of elementary principles, the cause and origin of the fluid matter of heat, the formation of atmosphere, &c. &c. It is a portable volume, small and pleasant for travellers." The work was never published, and its existence is scarcely known to any of his friends, but one or two copies were found amongst his papers, and a slight view of it is sufficient to show that it must have cost him considerable time and labour, at the moment his hands appeared to be full of other things.

A matrimonial connexion which Dr. Clarke had now for some time contemplated, rendering it necessary for him to enter into professional life, he determined to take

holy orders, and was ordained by his old friend, the Bishop of Bath and Wells, in Dec. 1805, and immediately instituted to the vicarage of Harlton, belonging to Jesus College. On the 25th of March 1806, he was married to the lady of his choice, Miss Angelica Rush, the fifth daughter of Sir William Rush, of Wimbledon; and to this union, from which, and for reasons apparently cogent, unhappy consequences had been anticipated by his friends, his future life was indebted for its greatest happiness, and even its prosperity.

On the 17th of March 1807, after encountering considerable difficulty in his project of lecturing on Mineralogy in the University of Cambridge, Dr. Clarke opened a course of Lectures on this branch of science on the 17th of March 1807. They were crowned with complete success; and in the course of the following year, his reputation as a Mineralogist, in the University, was so far established, as to encourage his friends in the hope of obtaining for him the establishment of a new Professorship in his name. This measure met at first with some opposition, and having been prematurely pressed, had in the first instance failed; but in the latter end of 1808, the second year of his Lectures, the sense of the University having been previously tried, a grace to that effect was brought up to the senate by the Proctor, the Rev. G. D'Oyly, (now Dr. D'Oyly, Rector of Lambeth, &c.) and carried almost unanimously.

The year 1817 opened with a most flattering testimony of the esteem in which he was held in the University, by his election to the office of Sub-Librarian, vacant by the death of Mr. Davies, and the promotion of Mr. Kerrich to that of Principal Librarian. His attention during this year was principally occupied by his experiments with the 'Gas Blowpipe.' In the same year he contributed two papers to the Society of Antiquaries, and one to the Geological Society. In 1819 he collected his experiments with the 'Gas Blowpipe' into a small octavo volume, which was published under that title, with engravings of the instrument, the safety apparatus, &c. This year also produced his Dissertation on the Lituus, read before the Antiquarian Society in 1820, and published in the Archæologia for 1821.

Dr. C. was one of the most zealous founders of the Philosophical Society of Cambridge, and drew up, for the first meeting, an address explanatory of the design and objects of the Institution. He afterwards communicated three papers to the Society, which were printed in the first volume of its Transactions.

The history now advances towards the close of a life which had been long struggling with labours disproportioned to his strength, and was at last seen to sink under the workings of a mind too powerful and too active for the mortal part with which it was united. The progress of his disorder was slow, but the steps of it were strongly marked. At no time since his return from his last journey could his health be considered as well established; and besides many other occasional derangements of his system, there was scarcely a single year in which the exertions and confinement attending his Lectures did not bring on some serious illness, frequently accompanying, but generally following them; and when these were over, instead of relaxation and repose, he often found such long arrears of composition or correction for his Travels as required the strongest application to recover. It was not so much the number and variety of his employments that broke down his health, as the extreme and intense anxiety with which some of them, particularly the philosophical, were pursued by him; an anxiety which intruded upon his hours of rest, and rendered him insensible to those corporeal warnings which usually guard other men against too continued or too intense an employment of their faculties. In the autumn of 1821, his wife, far advanced in preg-

nancy, and three of his younger children, sickened one by one with a typhus fever; and in a few days were all reduced by the violence of the disorder to a state of the most imminent danger. All happily recovered; but the fatigue and anxiety which Dr. Clarke underwent, aggravated the symptoms of his disorder, on its return in the winter of this year. This was succeeded by a sort of crisis, during which he was more thoroughly sensible of the perilous state of his health than at any other period, either before or after.

A short and deceitful interval of ease followed, in which the intermitting of the disorder gave him reason to hope that he was slowly recovering; under which impression he entered once more, in the middle of the month, upon a course of chemical experiments, preparatory to his Lectures, which were to begin in March; and from the moment he had stepped within the circle of these fascinating operations, there was no longer either thought or power of retreating; for the usual excitement attending this preparation co-operating with the effects of the disorder, which ultimately terminated in an affection of the brain, brought on a course of unnatural efforts, infinitely exceeding all his former imprudencies, and partaking strongly of the delirium which quickly followed. "I have left him in an evening," says a friend, "about this time, with a promise that he would go to bed, and on the following morning have found that he had been up a considerable part of the night, engaged in a series of unwholesome operations with sulphuretted hydrogen." In this melancholy state of self-abandonment, deaf to the remonstrances of his friends, insensible of his own danger, almost incapable of self-control, and intent only upon the due performance of his approaching duties, he supported an ineffectual struggle with his disorder till the middle of February, when his strength entirely failed him, and being no longer able to stand up, he sunk reluctantly into his bed, and from thence dictated to his servant the course of operations he wished to pursue, and there received from him the results. Up to this time, however, the arrangements of his mind seem to have been vivid and distinct as far as philosophy was concerned, and its energies unabated. His last paper, which was published in the *Annals of Philosophy*, is dated the 6th of February, and contains a clear statement of a complicated operation in chemistry, for obtaining cadmium from sheet zinc. On Tuesday the 12th, he wrote from his bed upon the same subject to the Rev. Mr. Lunn (who had frequently assisted him in his operations); and on Thursday the 20th, another letter to Dr. Wollaston, reporting his last operation. On Friday the 21st, Mr. Lunn saw him, when he was quite rational upon this subject, as far as he was permitted to speak, though sick and in bed. On Saturday he was carried to town for advice, by Sir William and Lady Rush, where he was attended by Sir Astley Cooper, Dr. Bailey, and Dr. Scudamore; but their efforts to save him were in vain. The rest of his life, about a fortnight, over which a veil will soon be drawn, was like a feverish dream after a day of strong excitement, when the same ideas chase each other through the mind in a perpetual round, and baffle every attempt to banish them. Nothing seemed to occupy his attention but the syllabus of his Lectures, and the details of the operations, which he had just finished: nor could there exist to his friends a stronger proof that all control over his mind was gone, than the ascendancy of such thoughts, at a season when the devotion so natural to him, and of late so strikingly exhibited under circumstances far less trying, would, in a sounder state, have been the prime, if not the only mover of his soul. One lucid interval there was, in which, to judge from the subject and manner of his conversation, he had the command of his thoughts as well as a sense

of his danger; for in the presence of Lieut. Chappel and Mr. Cripps, he pronounced a very pathetic eulogium upon Mrs. Clarke, and recommended her earnestly to the care of those about him; but when the current of his thoughts seemed running fast towards those pious contemplations in which they would naturally have rested, his mind suddenly relapsed into the power of its former occupants, from which it never more was free. At times, indeed, gleams of his former kindness and intelligence would mingle with the wildness of his delirium in a manner the most striking and affecting; and then even his incoherences, to use his own thought respecting another person, who had finished his race shortly before him, were as the wreck of some beautiful decayed structure, when all its goodly ornaments and stately pillars fall in promiscuous ruin. He died on Saturday the 9th of March, and was buried in Jesus College Chapel, on the 18th of the same month, leaving seven children, five sons and two daughters, the eldest not fifteen years of age at the time of his death.

CHEMISTRY OF DIGESTION.

Concluded from p. 132.

When the chyme has passed into the intestines, and has been blended and mixed with the bile, it separates into two portions, one of which, called *chyle*, is white, like milk, but possesses the properties of blood; the other passes on to the larger intestines, and is ultimately voided as excrementitious matter. With this latter we have nothing to do, further than to observe, that in the pursuit of knowledge men have not disdained to examine even the excrement of animals, though it does not appear that these examinations have thrown much light on the chemistry of digestion. One curious circumstance, indeed, has been inferred from M. Vauquelin's experiments. He found that the excrementitious matter voided by a hen contained a considerably greater proportion of phosphorus and lime than she had taken in, whence it was supposed that both phosphorus and lime* were compounds. Some of the constituents of excrement are also found in the chyle, and though we can state broadly that the excrement consists of matters which the assimilating and absorbing organs will not take up, we do not know what it is which induces these organs to reject some parts of the food and take others.

Chyle has also been frequently examined, but somewhat different results have been obtained by different chemists. It is an opaque white fluid, having a sweetish sour taste. By testing it with litmus paper, it shows signs of an alkali. It has no smell. After it is drawn out of the animal it coagulates in about ten minutes into a stiff jelly, and in twenty-four hours it separates into two parts, viz. a firm coagulated clot surrounded by a transparent colourless serum. Like blood, therefore, it coagulates spontaneously. In Vauquelin's opinion, the coagulum is an intermediate substance, between albumen and fibrin, and is on its way to be converted into the latter. It possesses properties closely resembling the caseous portion of milk. On evaporation it leaves a substance analogous to sugar of milk. Phosphate of lime and carbonate of soda are also found in the chyle. Dr. Marcet found a great difference in the chyle of herbivorous and carnivorous animals, while Mr. Brande found no distinctive difference in the chyle of these two classes of animals, the chyme of herbivorous animals containing as much nitrogen as that of animals fed on flesh. This, it must be remarked, is a curious circumstance, and gives rise to the supposition that nitrogen is a compound body. It scarcely exists in the food of the herbivorous animals, and yet Mr. Brande could

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* This supposition has since been verified by Sir H. Davy as to the latter substance, and there are other reasons besides that stated by M. Vauquelin for believing phosphorus to be a compound.

find no difference between the composition of their chyle and that of animals fed exclusively on meat.

By what means exactly chyme is converted into chyle is not known, though the principles of the change are chemical. The bile evidently contributes materially to the change, and it has been conjectured that its aqueous, and perhaps its alkaline parts, enter into the composition of the chyle, while the albumenous-resinous matter combines with the excrementitious portion, and tends to stimulate the intestinal canal, and promote the expulsion of the excrement. From the disordered state both of the bowels and of the general health whenever the bilious secretion goes wrong, it seems that this secretion is quite necessary for the conversion of chyme into chyle, and more particularly for separating and promoting the expulsion of that part of the food not taken up for the nourishment of the body. Sir Everard Home supposes, that in the large intestines a portion of the food not proper to form chyle and be transmitted to the blood, is converted into fat, absorbed, and distributed to different parts of the body. The great resemblance of chyle to blood has been noticed by all observers. The albumen it contains differs a little from that in the blood, and it is of a very different colour. In blood, too, the saccharine principle which we find in the chyle is no longer sensible; whence it would appear, that in the progress of circulation the properties of the chyle are further changed. After this fluid has been formed in the intestinal canal, it is there taken up by a great number of absorbing vessels, called lacteals, from conveying this milk-like fluid, and by them is carried into a tolerably large vessel, called the *thoracic duct*. Here it is again mixed with a transparent fluid, called *lymph*, which is conveyed to the thoracic duct, by vessels called *lymphatics*, from all the cavities of the body. From the difficulty of procuring lymph, it has not been examined with accuracy. Common salt and albumen have been found in it, but no trace of iron. The effects of its union with the chyle is not therefore known; but the latter undergoes no change in colour or external properties. The chyle and lymph are conveyed, thus mixed, into the blood; the thoracic duct which conveys them beginning on the third vertebræ of the loins, passing upward in the body to the left side of the neck, and terminating in the venous system at the junction of the left subclavian and carotid veins. After mixing with the blood the chyle is conveyed to the heart, and thence propelled into the lungs, where it undergoes a further change from respiration. Such, then, is a short and imperfect account of the process by which food is converted into blood, and serves for the nourishment of the body and the maintenance of life. In the stomach it is converted by the saliva and gastric juice into chyme, it then passes into the intestinal canal, and is converted by the pancreatic juice and bile into chyle and excrementitious matter, the latter is expelled, and the former absorbed and mixed with the blood. Although the elements of food and the elements of blood are pretty well known, the intermediate chemical changes by which one is converted into the other are not thoroughly understood; and till they are we shall be in the dark, as at present, as to what constitutes the nutritive powers of different substances.

DICTIONARY OF CHEMISTRY.

Digestive Salt, *muriate of potash*, *chloride of potassium*, *regenerated sea salt*.

Diopside, *alalite*, *mussite*. A subspecies of the mineral *augite*. It consists of 57.5 silica, 18.25 magnesia, 16.5 lime, 6 iron and manganese.

Dioptase. Emerald copper ore.

Dippel's Animal Oil. A peculiar volatile animal oil, so called from a chemist of the name of Dippel having first noticed it. It is

obtained from distilling horn and such substances, and it is the product of the first distillation. When rectified it is colourless, aromatic, and almost as light and volatile as ether. It has some alkaline properties, from holding ammonia in solution, and was formerly used as a specific in fevers.

DIPYRE, *schmelstein.* A mineral hard enough to scratch glass; it is found in the Pyrenees, and consists of 60 silica, 24 alumina, 10 lime, 2 water, and 4 loss.

DISTHENE, *sappare, cyanite.* A mineral of a very complex nature, first described by M. Saussure.

DISTILLATION. The separating one substance which is vaporized at a lower temperature, from another which at that temperature does not rise into vapour, and afterwards collecting and condensing it. This is the general nature of the operation, It is susceptible of numerous modifications, and is conducted in very different modes, some of which have been already described under the articles on Distillation, which see.

————, DESTRUCTIVE.—When organised substances are exposed to distillation till the fire has expelled all it can expel, the process is called Destructive Distillation.

DOCIMASTIC ART. The art of *assaying* is so called.

DOLERITE. A modification of *basalt*, but the term seems only adopted by French geologists.

DOLOMITE, *magnesian lime stone, calcareous magnesian carbonate.* A mineral so named after a celebrated French geologist, M. Dolomieu. There are several subspecies, but they all consist principally of carbonic acid, lime, and magnesia

DORKING LIME deserves a place in a chemical dictionary, from its valuable properties, owing to its containing some oxide of iron and alumina, which render it more suitable for mortar than lime which is quite pure.

DOUBLER. An electrical instrument, intended, as its name implies, to double small quantities of electricity.

DRACO MITIGATUS, *calomel.*

DRAGON'S BLOOD. A brittle, dark-coloured resin, used as a medicine, and imported from the East Indies. It stains marble, when heated, of a beautiful red.

DRAWING SLATE, *black chalk.* The best species of this mineral, which consists principally of silica, lime, and carbon, is found in Spain and France.

DUCTILITY, in metals, the property of being drawn out into wire, so that their thickness decreases and they do not break.

DUTCH GOLD, *copper or brass leaf.*

DYEING. The art of giving different colours to different substances, principally cloths, of whatever material they are made. It is a chemical art, and has been much improved by modern discoveries. In giving permanency and brilliancy to their colours, the French are said to surpass the English, and not to be indebted for this to their clearer sky and brighter sun.

DYKES, *troubles*, in mining, fissures or breaks in the strata of metal or coal, or veins of hard black rock, which thwart the miners, and hence the name of *troubles*.

EXPANSION OF WATER BY FREEZING.

To the Editor of the Chemist.

SIR,—It is well known, that any quantity of matter occupies less space in a *globular* than in any other form. All fluids have a tendency to assume a globular form, by the reciprocal attraction of their parts. Bodies passing from a fluid to a solid state, arrange their parts in *angular* divisions of the whole mass; and thus with the spaces, or interstices between the angles, any quantity of matter, whose molecules are so arranged, must necessarily occupy more space than when closely compacted in a spherical shape.

The fact of water *expanding as it cools*, and *before it crystallizes*, I confess, had escaped my observation; nor do I recollect seeing the circumstance noticed in the course of my reading; but taking it for granted

it is certainly a difficult problem. May I venture to suggest that *electricity* may have a share in producing this effect? From some experiments I have lately made, I find that water, when charged with a certain quantity of electricity, parts with it slowly; and I have reason to believe, that it is retained longer by cold water than either by warm water or by ice. Perhaps there may be opposite electricities in water at different temperatures. This is worth investigating.* Now, I would account for water remaining fluid below 32°, by its not being in a situation to receive the necessary electricity by which the attraction of its parts may be so altered as to take up a different arrangement. We know that when water is at this low temperature, motion will change it into ice, or the same effect may be produced by bringing a piece of ice in contact with it. This I suppose to be effected by the agency of electricity, producing a different kind of attraction, and consequently a new arrangement of parts; and this, by an opposite electricity, excited by motion, or communicated by contact with a substance already charged with it.

I have thrown together these remarks as they have suggested themselves to me in the course of my limited experiments. If they appear to you to be worth attention, you are quite at liberty to insert them, or any part of this and my former letter, as you may think fit. I consider your publication as highly useful and valuable; and shall be proud to occupy a corner of it, if any of my suggestions can tend to induce investigation, or elicit information. I am, &c

Nov. 30, 1824. TYRO-CHEMICUS.

* It is well known that several bodies become electrical by heat; and that water, in passing from a liquid state into vapour, generates electricity.—See Chemist, No. 36, p. 117, vol. ii.

QUERIES.

The best chemical process for working crude platina into crucibles, wire, &c.?

The same for extracting rhodium, and forming it into pieces, as nibs to metallic writing pens, &c.?

ANSWER TO QUERY.

TO MAKE PASTILS.

THE following receipt, taken from Paris's Pharmacologia, I think is superior to any:

Take of flowers of Benjamin 2 drams; powder of cascarilla bark, and powder of nitre, of each a dram; powder of myrrh, half a dram; charcoal, $1\frac{1}{2}$ oz.; oil of nutmegs, and oil of cloves, of each 15 drops; mucilage of gum tragacanth, sufficient to form a mass. H. R. W.

N.B. These must be put into a slow oven, or in a cheese-toaster, before the fire to dry, as they will not burn if they be the least damp.

TO CORRESPONDENTS.

The communications of W. G. came too late for our present Number, but one of them at least will appear in our next. We will thank him to make the experiment he mentions.

Our Canterbury correspondent, "A Subscriber," should wash his coffee well with cold clean water, and then dry it thoroughly, at a low temperature. If the weather is fine, spreading it out and exposing it to the air and sun will be sufficient; if not, he may spread it in a room in which a fire is kept. When it is dry, he may roast it by the usual methods, but he had better apply a little more heat than is in general applied.

"Veritas" will see that some of his Queries are inserted; one has been omitted, because a similar query from another has already been published. We are not, as he will readily believe, sufficient connoisseurs of port wine to answer his question on this subject.—Wine, however, which has been long bottled, deposits a considerable sediment, and some of this separating from the bottle, and floating in the form of light film in the wine, may have given rise to the notion of the bee's wing. In countries where wine is both good and plentiful, we have never heard of its being admired for this sort of impurity. This is a factitious, and, we are afraid, exclusively an English taste.

"Tyro Chemicus" is requested to communicate to us for the benefit of H. R. W. and other correspondents, what sized iron turnings he puts into his electrical bottles.

J. G. and E. J., of Hanley, Stafford, shall be attended to.

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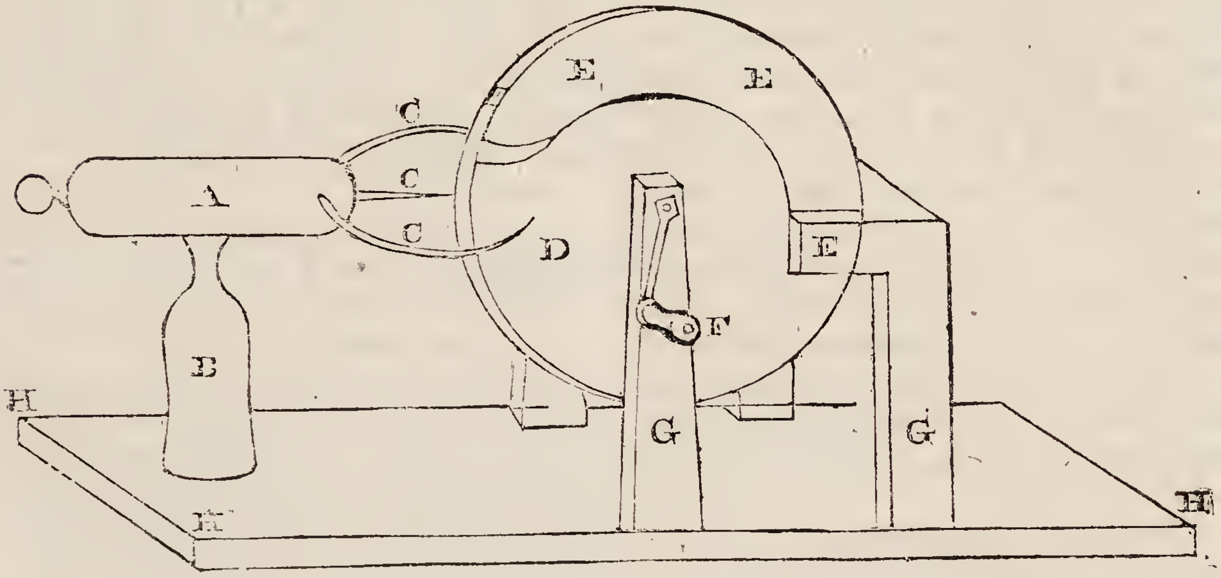

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CHEAP ELECTRICAL MACHINE AND JAR.

To the Editor of the Chemist.

Sir,—In a late Number of your Magazine, in Notices to Correspondents, I observed "A Young Reader" wished to make a cheap electrical machine. The following will be found the cheapest, and, as it is not generally known, may prove interesting to many:—

Procure a very dry circular plate of wood, of any circumference, about an inch thick. Glue round the edge, and on both sides, brown paper, care being taken to lay it on smooth; when quite dry, two more coatings are to be put on in the same manner. A spindle is then to be fixed in the centre, and placed on two uprights, in the same manner as a plate electrical

machine; a piece of wood is then to be cut in the shape of a staple, and a cloth cushion fixed in it, to press moderately on both sides and edge of the coated wheel; a cloth cap fixed to the cushion is to extend over a third part of the wheel. The cushion may extend three inches on each side of the wheel.

The conductor may be made in the following manner:—A piece of wood of the shape required is to be covered with tinfoil; a stout brass wire is to be inserted through one end, and bent to come nearly in contact with the sides of the covered wheel; a shorter wire is to be fixed in the centre of the conductor, to collect the electricity from the edge of the wheel. To the other end of the conductor a short wire and brass knob are to be fixed, and the conductor itself must be placed on a glass tube or dry wine bottle.

The jar, or Leyden phial, may be made by gumming the inside of a wine bottle with thick gum-water, by means of a brush fixed on a stick, within two inches of the shoulder. Granulated tin is then put in, and the bottle turned gently round, when the part that is gummed becomes quite coated, and dries; the tin that has not adhered may be poured out. The bottle must be coated on the outside with tinfoil, and a brass wire inserted through the cork, as in other jars. This plan for the jar is, I think, preferable to that described by Tyro Chemicus.

I suspect the warmth requisite to work the machine would cause a slight evaporation of the water in the bottles, which would condense on the upper part and neck of the bottle, and form a very good conductor for his electricity to escape by.

I subjoin a sketch of the machine, which you can omit if you think the description will be understood without it. By inserting this you will oblige

A constant reader,

W. G.

A is a conductor. B a wine bottle-stand. C C C wires to collect the electricity from the wheel. D the coated wheel. E E E the cloth cap and cushion. F the handle. G G uprights for wheel and cushion. H H H the stand.

For experiments with pith balls, or for the pigeon-house described some time ago in your Magazine, the dried pulp of the colocynth will be found preferable to elder pith: four pigeons, the bodies half an inch long, with wings of silver paper one inch long, weigh only one grain. A ball of it, an inch and a quarter in circumference, also weighs only one grain.

W. G.

LECTURES ON CHEMISTRY AT THE ROYAL INSTITUTION.

CHLORINE. IODINE.

LECTURE 16. The next of the electro-negative bodies to be brought under notice is Chlorine. This substance was first discovered by Scheele, in 1774, and called by him *dephlogisticated muriatic acid*, from supposing it was muriatic acid deprived of phlogiston. By Berthollet, and the French chemists, it was afterwards called, from another theory, *oxy-muriatic* acid, a term which continued in use for a considerable period, and was adopted by most of the chemists in Europe. Subsequently, however, it was called chlorine; a name which has no reference to any thing but its colour, and at present it is distinguished by this name in the writings of almost every modern chemist. To obtain chlorine, put a quantity of black oxide of manganese, and about five or six times its weight of muriatic acid, into a retort, and apply the heat of a spirit lamp: a gas is soon copiously evolved, which is chlorine, and may be collected, but cannot be well preserved over water on account of that fluid slowly absorbing it. To breathe this gas, even in small quantities, occasions coughing and unpleasant inflammatory effects; in order therefore to prevent its mixing with the atmosphere we breathe, care is taken not to allow the first portions which

come over to escape; but they are collected, and being not fit for experimenting on, are afterwards let loose where they can do no harm. Chlorine may also be obtained from a mixture of, 8 parts common salt, 3 black oxide of manganese, 4 water, 5 sulphuric acid. This is the method generally employed for obtaining it on a large scale, and is the one by which it is obtained for bleaching and other arts and manufactures. It is worthy of notice, that the oxide of manganese, from which oxygen has been already obtained, answers very well for procuring chlorine. Mr. Brande employed both these methods, and obtained chlorine by both. After it has been made, it should be put into glass vessels with ground stoppers, greasing the stoppers, so that there may be no difficulty in getting them out when wanted, and it may then be preserved for any length of time.

Chlorine in its properties is distinguished as going always to the positive pole of the Voltaic battery, or as being electro-negative; and in the present state of our knowledge, we must consider it as a simple substance, as it has resisted all the efforts hitherto made to decompose it. There is, however, strong indirect evidence, many reasons drawn from analogy, to believe it a compound, but no experiments yet made have resolved it into any other, or elementary bodies. Its effects on the lungs are very irritating, and if breathed in any quantity, produces great inflammation. It has a pungent and disagreeable smell, and is of a greenish yellow colour. The weight of 100 cubic inches is 76.25 grains, its specific gravity, compared to air, is as 2.5272 to 1.0000, or as 25 to 10; compared to hydrogen, it is as 36 to 1. In its ordinary state it is a gas; but Mr. Faraday, by subjecting it to a pressure of four atmospheres, has reduced it to a solid state. Some solid chlorine was exhibited, inclosed in a glass tube, sealed by the blow-pipe, after the pressure had been applied. When dry it suffers no change by being exposed to an intense cold, as Sir Humphry Davy has proved, but in its ordinary state it contains aqueous vapour; and when exposed to a temperature of 32°, this is deposited in crystals, which are again taken up on the application of heat. No change is effected on chlorine by passing it through red hot tubes, if they be made of a metal which it does not decompose. Water, at the temperature of 60, absorbs twice its own volume; the solution has a pale yellow colour, has an astringent taste like chlorine itself, and destroys all kinds of vegetable colours. This is effected by some combination and decomposition, depending partly on the action of water; for if the chlorine be perfectly dry no change is produced in the vegetable colour. In bleaching it is used united with lime, or as a chloride of lime.

Its powers, as a supporter of combustion, come next to be considered. A taper immersed in it burns with a dim red flame, the light appears very feeble, much charcoal is thrown off, and the taper is soon extinguished. Other substances however burn in chlorine with much brilliancy, and take fire spontaneously. Phosphorus is one of these substances; and to burn it in chlorine, we place a small portion of it in a retort; we then exhaust the retort, and, when exhausted, apply it to a jar containing chlorine, and fill it, when the phosphorus instantly catches fire, and burns with a bright flame. There is a compound substance formed, called chloride of phosphorus. To perform this experiment, the retort is provided with a stop cock and brass nozzle, which both fits to the air pump and to the jar containing chlorine, which is also provided with a stop cock. It may here be necessary to remark, that in exhausting retorts, from their peculiar shape, and from the inequality of the glass, they are very liable to crack by the mere presture of the atmosphere. To prevent the pieces flying about, and injuring any person, it is proper to cover them with a napkin or

pocket handkerchief while the air-pump is working. By experimenting in the same manner on very thin copper placed in the retort, or rather brass leaf, it instantly catches fire in the chlorine, and is consumed. In this case also there is formed a compound of chlorine and of copper, called a chloride of copper. From these examples we are entitled to conclude that chlorine is, in ordinary language, a supporter of combustion; and the strength of the chemical attraction is so great that spontaneous combustion ensues.

Chlorine and oxygen unite and form three, some chemists have stated four compounds; the three which are known are, one oxide and two acids. The oxide has been described by Sir Humphry Davy, its discoverer, and called by him euchlorine, from its very intense yellow colour. It may be obtained by dropping on 10 or 12 grains of chlorate of potassium, slowly and carefully, a small quantity of sulphuric acid, stirring the mixture, which will then appear like a moistened yellow powder. Put it into a small retort or bent tube, and place the tube in a water bath of the temperature of 150°: oxide of chlorine passes off, and may be collected over mercury in small jars or tubes. Almost any increase of temperature will separate the oxide of chlorine. It is necessary to operate only on very small quantities of this substance, on account of its great liability to explosion. Whenever it is gently heated it explodes with considerable violence, and is decomposed. It is very difficult therefore to preserve it. One hundred cubic inches weigh between 74 and 75 grains. Its specific gravity, compared to common air, is as 2.40 nearly to 1: to hydrogen it is as 3.4 to 1. It is of an intense yellow colour, its taste is astringent, and not at all acid. It has been said to have the smell of burnt sugar, but this is an analogy I could never discover. When heated, this gas gradually enlarges its volume, and then is decomposed, expanding suddenly into two volumes of oxygen, and one volume of chlorine, occupying a space one-third larger than before. In its combination, therefore, we have three volumes, viz.: two of oxygen, and one of chlorine, condensed into two. When this gas is decomposed, a sudden flash of light is seen. This experiment was exhibited. A small quantity of it was put into a narrow tube, the mouth of which was kept inverted over mercury, and the flame of a spirit lamp applied to it, when it almost immediately exploded. On repeating this experiment, and not confining the tube, it was projected across the laboratory with considerable violence. Another oxide of chlorine has been described, but I am disposed to regard it only as this oxide, having a quantity of chlorine mixed with it.

The two combinations of chlorine and oxygen, which form acids, are called the chloric, and the perchloric acids. The former is obtained by passing a current of chlorine through a mixture of oxide of silver and water; the chloric acid remains in solution with an excess of chlorine, which may be driven off by heat, and chloride of silver, which is insoluble, may be separated by filtration. It consists of four* volumes of oxygen and one of chlorine, and is thus represented:

Ox.	Ch.
8	36
8	
8	
8	

the equivalent number of the compound being 68. It is a compound which is easily decomposed consistently with the theory of combination depending on the electrical states of bodies. Two electro-negatives are here combined, chlorine being so in a less degree than oxygen; the union is very feeble.† Chlorine acid is a sour

* Some authors state the proportion of oxygen to be five.

† We could have wished this point had been further elucidated. Mr. Brande is of course not ignorant that the combination

colourless liquid, producing, with other substances, peculiar compounds, called chlorates, which I shall hereafter advert to. Perchloric acid consists of five volumes of oxygen and one of chlorine; or by weight, 36 of chlorine and 40 of oxygen, and is thus represented—

Ox.	Ch.
8	36
8	
8	
8	
8	

its equivalent number being 76. Of this compound little is known; and as it exists only in certain salts, I shall mention it again when I treat of them. The proper name, I should observe, for these two acids, according to the principles of our nomenclature, should be *chlorous* and *chloric* acids, and then the salts they form would be called *chlorites* and *chlorates*: at present, the compounds of the per-chloric acid are called *oxy-chlorates*.

Iodine, the next of the electro-negative bodies, differs from the two other electro-negative substances already examined in being a solid. It was discovered, in 1812, by M. Courtois, a manufacturer at Paris, who was at a loss to account for a certain effect which always took place on his iron vessels. No efforts of art have yet decomposed this substance, but there is some reason to believe that it is not an element. It is obtained from kelp, by washing it in cold water, and the lixivium is to be evaporated till a pellicle forms, and then set aside to crystallize; when it no longer deposits crystals, evaporate the mother liquor to dryness, and pour on the mass half its weight of sulphuric acid. Put it into an alembic, with a large head or capital, having a tube, and terminating in a globular shaped receiver. Fumes of a violet colour arise, and condense in the form of opaque crystals. This is iodine. The crystals are a steel greyish colour, and have a metallic appearance; but not being a conductor of electricity, is a sufficient reason not to class it with metals. It may also be obtained by a somewhat similar process from soap makers' black ash. Care must be taken in the process to exclude common salt, otherwise chlorine comes over and vitiates the iodine. It is a soft friable substance: it produces a yellow stain on the skin, and renders vegetable colours yellow. Its taste is acrid, and its smell resembles that of diluted chlorine. At a temperature of 80, it rises in a violet coloured vapour. It is a very feeble supporter of combustion, and yet potassia burns brilliantly in its vapours. It is an electro-negative body, always going to the positive pole. The specific gravity of its vapour, as compared to air, is 8.7775; as compared to hydrogen 127. It combines with oxygen and chlorine, and forms two compounds, called iodic and chloriodic acids. Neither of them are very important bodies; and I may here remark, that I shall not, in speaking of the different compounds, do more than merely mention those which have not in themselves, nor in the salt they form, any thing interesting. The iodic acid consists of five volumes of oxygen, and one volume iodine, and is thus represented—

Ox.	Io.
8	125
8	
8	
8	
8	

It cannot be formed directly, for oxygen and iodine exert no mutual

of any two electro-negative, or electro-positive bodies is in direct opposition to that theory which supposes bodies only unite from possessing opposite states of electricity. We are therefore of opinion, that this objection should have been boldly and openly stated, and if possible answered; or it should be plainly acknowledged that this theory, like others, does not explain the phenomena, and that we must more rigidly confine ourselves to facts.

action on each other, and it is procured by acting on the compound of chlorine and iodine. The chloroiodic acid is easily obtained by the direct action of chlorine and iodine. It consists of iodine 127. and chlorine 36. In terminating his remarks on the electro-negative bodies, Mr. Brande observed, that the terms sometimes given them of acidifying, and supporters of combustion, might lead persons into an error, as they might be called acidifiable, and the electro-positive bodies might be called supporters of combustion with equal propriety. These terms might be changed, and applied to the opposite class of bodies, without contradicting any facts.

The first of the electro-positive bodies to be treated of is hydrogen, which is known to us only in the state of a gas, and has never yet been liquefied by art. It was early known to the investigators of chemistry; but Mr. Cavendish was the first person who obtained it in a pure state, and closely examined it. We always procure it from decomposing water; either by electricity, or by the action of iron or zinc and sulphuric acid, diluted by water. The gas is readily disengaged, and may be collected over water. It is inflammable and extinguishes flame. A lighted taper is extinguished by it, but the taper sets it on fire. It burns with a lambent blue flame, but only at the surface, in contact with air; thus you see the flame gradually spread through the glass. If mixed with thrice its volume of air, it burns rapidly, and with detonation; or if mixed with half a volume of oxygen, and a light be brought to it, a violent explosion immediately ensues. Both these experiments are very easily performed. For the first, it is only necessary to fill a small tube one-third full of hydrogen, and then allow the atmospheric air to fill the rest of the space: apply a taper, and an explosion instantly takes place. For the latter, it is only necessary to substitute oxygen instead of common air, and fill the tube two-thirds full of hydrogen. Both these experiments were performed without apparently any trouble. In the next lecture, I shall more particularly call your attention to the specific gravity of hydrogen, as this is of considerable importance, it being the standard of comparison for other gases.

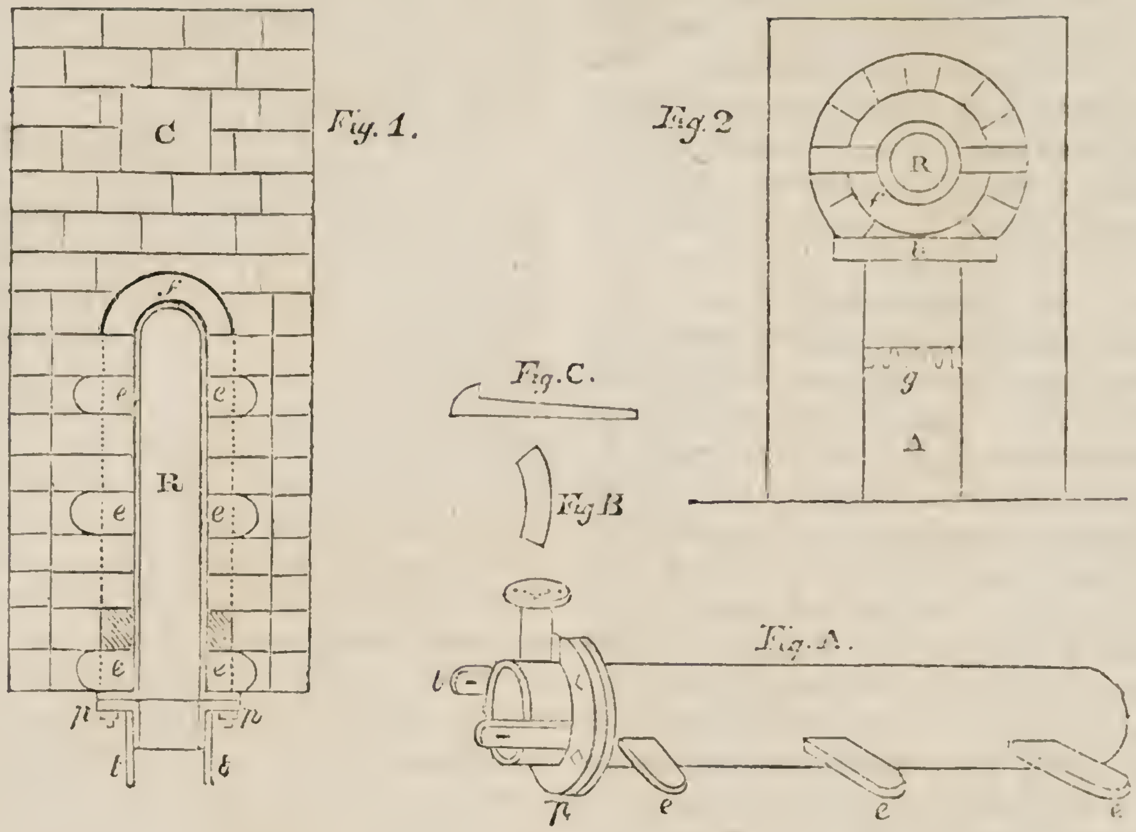
GAS LIGHTS.

It has been, we think, justly observed by Dr. Ure, that the introduction of gas lights "is one of the most capital improvements which the *arts of life* have ever received from philosophical research and sagacity." But since the introduction of coal gas, of which alone he spoke, we have had gas from oil recommended to our use; and though the superiority of either depends on such a variety of circumstances that it perhaps cannot be immediately decided, we must consider the improvements to which the introduction of coal gas promises to lead as not less valuable than the thing itself. In consequence of oil gas giving, in proportion to its bulk, a much greater quantity of light than coal gas, it has been compressed into strong iron vessels, easily portable, and our houses and drawing-rooms may now be illuminated by lamps that never need snuffing, sputter no grease, spoil no clothes, make no dirt, and never give a single spark. They may be carried about without danger, and if turned over or let fall, neither spill oil nor tallow. In general they are not yet adopted, because people adhere to old practices, and hate novelties; but ultimately they will come into use, and we shall be saved both dirt and trouble, and the risks of fire will be diminished. But the direct benefits conferred on mankind by scientific improvements are perhaps not so great as those which indirectly arise from them. From the more brilliant manner in which our streets are lighted by gas than ever they were, or could be with oil or tallow, there is a greater degree of security, both in person and property,

for every class of honest men. Crimes cannot now be committed in darkness and secresy; as the risk of detection increases, the temptation to guilt is diminished; and thus coal gas, by the brilliant light it sheds in our streets, has worked, and is now working, a moral reformation. The burglar and the pickpocket dread the lamps much more than they do the watchmen, and no more efficacious measure of police was ever introduced into society by the contrivances of politicians directed to this end, than has incidentally resulted from gas lights. But this is not all: lighting our streets and houses with gas is a new art, and gives birth to several new trades; and as these new trades have arisen at a time when the improved sense of society has discovered the injurious nature of the restrictions formerly imposed on industry, they are allowed to be freely exercised. The same circumstance is common to many other newly discovered arts; and by the practice of which numerous classes of men gain a livelihood. Already in our country the professions and the trades which are thus liberated from corporation laws are not a few, and they promise ere long to become the majority of professions and trades in society. One consequence, therefore, of scientific discoveries and scientific improvements, not at first expected from them, is to liberate mankind, without political convulsions, from the thraldom of unwise regulations. We know not if we can offer to our readers, after the strong excitement of pecuniary advantages, (for discoveries and improvements, as will be evident from what we last week mentioned of Mr. Brown's patent, do not go unrewarded,) any more powerful motive for assiduity in the pursuit of knowledge, and forbearance from all political tumults, than in thus showing them the effect of scientific discoveries in promoting general improvement. It is gratifying to see society, by the progress of knowledge, casting aside some of its prejudices with each revolving year, and, like a young Hercules, gradually outgrowing and bursting asunder all the bands which have restrained its infant limbs.

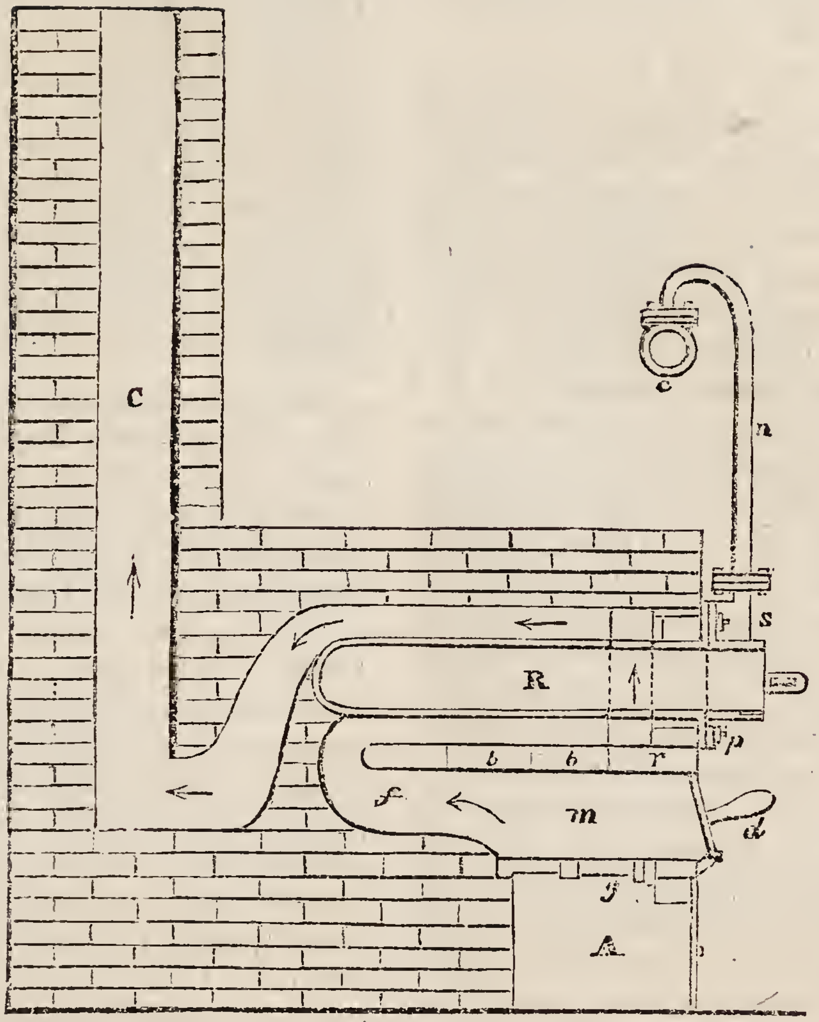
The first person who applied coal gas to the purpose of producing light seems to have been a Mr. Murdoch, who made experiments for this purpose at Redruth, in Cornwall, in the year 1792. Sixty years before his time, however, a Dr. Clayton collected the gas from coal in bladders, and burnt it; thus at least showing the practicability of the thing, though he did not carry it into execution. Mr. Murdoch exhibited his experiments to numbers of his friends in 1796; and in 1798, he constructed, at the Soho Foundry of Messrs. Bolton and Watt, the first apparatus that was ever used for lighting a building. He afterwards made several improvements in it, and in 1802, on the conclusion of peace, he made a grand display of these lights at the Soho works, which excited much astonishment. Under his direction the large cotton manufactory of Messrs. Lee and Phillips, of Manchester, was lighted with gas in 1805. After that period it was gradually introduced into most of the large manufactories of the kingdom, and was gradually substituted in London and some other towns instead of oil to light the streets at night. At present most of the large towns of this kingdom are lighted by gas, or are on the point of being so lighted. Several towns on the Continent have also adopted the same expedient; and more lately a Company has been formed in England, for lighting various towns on the Continent in this manner. It is our intention to give our readers an account, extending to two or three articles, of the mode of distilling coal to procure this gas, of the principles of the art, and of its comparative advantages. We shall first give a short description of the most necessary parts of the apparatus.

When coal is exposed to the process of destructive distillation,



the principal products obtained are water, tar, and ammonia, which are condensable by water, carburetted hydrogen, sulphuretted hydrogen, hydrogen, and carbonic oxide. The gases which burn are the hydrogen and the carburetted hydrogen; and the object of the distillation is to obtain them in a state of purity and in the largest quantity. For this purpose the coal is put into an iron retort, of a cylindrical form, its length being from seven to eight times its diameter. It has an opening at one end, which can be closed by a lid with a conical edge, and pushed up to its place by a catch or wedge. The retort is placed horizontally in a furnace, which allows the flame to pass under it in the direction of its length, and over it on its return, after which it enters the chimney.

At some distance from the mouth of the retort, which projects a little way beyond the brick-work in front, a pipe ascends from the upper side, and at right angles to the length of the retort. Through this the gas escapes, ascending first, and then the pipe turning, it descends into a wide pipe, placed in a horizontal position. This last is called the condenser. From the end of this pipe an inclining pipe proceeds, which conveys the gas, and also the tar, after it has accumulated in the condenser, till this last admits it to run off. The gas and tar now proceed together, the former occupying the upper half of a longitudinal section of the pipe, and the latter the lower half. The tar is at length deposited in a vessel, from whence it can be drawn at pleasure. The gas first ascends from the pipe in which it was accompanied by the tar, and then descends into a vessel containing a mixture of lime and water, by which it is purified. It then passes into an apparatus called a Gasometer. This consists of an outer vessel filled with water. A second vessel, less in diameter, is inverted and immersed into the first. If the common air be allowed to escape from the inner vessel, it will freely descend, and water will occupy the place of the air. If now the source for the escape of air be stopped, and the inner vessel counterpoised by a weight, the inflammable gas, purified as above, may be admitted under the inner vessel, which will ascend to make room for the gas. The suspended



vessel is a little heavier than the weight, so that if the force of the entering gas were withdrawn, and an opening made to permit the air to escape, the vessel would descend. This apparatus is not only a reservoir for the gas while its production is going on, but it serves to force out the gas to be burnt, with a gradual and uniform pressure, which gives steadiness to the flame. The gas is set on fire when it is escaping through one or more small apertures, about one-thirtieth of an inch in diameter. These are sometimes disposed in a circle, about the size of the circular wick of the Argand lamp, and hence have been called Argand burners. A glass is placed over them, similar to the Argand lamp. The gas tube sometimes terminates in a spherical head, perforated with different numbers of holes.

Fig. 1 in our Plate represents a plan and section of the furnace containing the retort. In Fig. A, which is a perspective view of the latter, *c c c* are projecting pieces for the retort to rest on, and the same letters point out the same pieces in Fig. 1. *p* is the place where the two parts of the retort are screwed together. *t t* are two ears, through which the wedge C fastens on the lid B. The fire-place is shown at *m*, in the figure on this page. *s* is a pipe with a plunge, to receive the pipe *n*, which is cast with the front of the retort; and *c* shows the large pipe called the condenser. *d* the door, *g* the grate, A the ash-pit, and *f* the flue. The flame passes along the flue under the retort, where it reaches *r*, and rises to the upper side of the retort, and passes into the chimney C. In Fig. 2. at *f f*, the separation of the lower half of the flue from the upper is seen; *b b*, in both figures, are long fire-bricks, which separate the fire-place from the bottom of the retort, and prevent the action of the flame from destroying the retort.—(The remainder of the plates and description we must reserve for our next.)

To PREVENT ACCIDENTS FROM THE BURSTING OF STEAM-BOILERS.

The late dreadful occurrence at Manchester, in which, by the bursting of a high-pressure engine-boiler, five men were killed and several severely wounded, and the whole town of Manchester thrown into consternation, has excited a deep and painful interest. The public voice has been raised, and is still rising, in consequence, against high-pressure engines.—The Editors of more than one public journal have expressed their wishes that no more should be erected, and that those which are now in existence should be forthwith pulled down. Now, this seems to us most unreasonable; and if we are to act on such suggestions under the panic terror of a momentary disaster, farewell to all general improvements. It has lately been stated, and apparently on good grounds, that unless high-pressure engines are adopted, many of the best of our steam packets must be given up, as too expensive, they not remunerating their owners. High-pressure engines are undoubtedly much more economical than the others; and these boats will continue to run if they can be employed. The persons, also, who have invented or improved them, have asserted, that they are as safe and as little liable to accident as other engines; our business, therefore, should be, not to raise an outcry against them on account of one accident, but inquire rationally into the means of making them as safe as they are economical.

The advantages of these engines are thus described in a Report lately presented to the Academy of Sciences at Paris, by the very first scientific men in France:—

"Amongst the advantages of high pressure engines, that of occupying the least possible space must be enumerated, and will be the more important, as the space for their erection is more confined, or the ground more valuable: where manufactories, and private houses, are so crowded together that each establishment can obtain but a very limited space, and great power is at the same time necessary, this advantage is particularly felt; and it is no less important in the interior of mines, for the same reason.

"A second advantage of high pressure engines, and one that is even greater than the former, is the economy of fuel which results from the effects of a high temperature. This will be readily granted, when it is stated that the repairs and expenses of the steam-engines employed in draining a single large coal-mine in England, amount annually to the sum of 25,500*l.*"

In Cornwall the proprietors of the mines have kept accounts of the savings resulting from improvements in engines, by which it appears that in December 1812, the quantity of water raised one foot, by the consumption of a bushel of coals, was 18,200,000lbs., while at present Watt's improved engines raise above 30,000,000lbs. in the same time, and at the same expense of coals. But a Woolf's engine, two of which were in 1815 in use in Cornwall, and which work with a pressure intermediate between that of high and low pressure, raised 46,255,250lbs. of water in the same time at the same expense. The following fact, independent of all theory, which it however only confirms, is still more decisive:—

"In Philadelphia, the saving of fuel by the substitution of one of Evans's high pressure engines for the low pressure one previously employed, amounted to about 1250*l.* per annum. This engine raises 20,000 tons (*tonneaux*) of water, about 93 feet in height, every 24 hours, and consumes about 1535 cubic feet of wood per diem. The prime cost of the machine was rather more than 5000*l.*; whereas, according to M. Marestier, a low pressure engine, of equal power, would cost considerably more than 8000*l.*

"Evans's engines work with a pressure of from eight to ten atmospheres; and several of them have been constructed in America."

The question is, then, are these palpable advantages to be given up because some accidents have happened, or shall we take precautions against them? The following are the recommendations of the French scientific men:—

"It results, (say they,) from all the details which we have collected, that no mean or high pressure steam boiler, constructed in any regular establishment in France, has ever met with an explosion;

although they are more numerous than those imported from foreign countries. During the last year, 36 of these engines have been made in one manufactory at Paris, and a still greater number are making in the present year; and the more they are used the more they are approved of. Since 1815, more than 120 mean and high pressure engines have been made in the French manufactories.

"Since 1815, 32 mean pressure engines have been sent to St. Quentin, from one manufactory at Paris; and the purchasers are universally well satisfied with the service they perform.

"It became important to ascertain if the safety of the French engines, from their introduction to the present time, be merely owing to chance, or if it be the necessary consequence of multiplied precautions in their manufacture, and the previous trials to which the boilers are submitted. On this point the following information has been obtained respecting the cast iron boilers, which are considered as the most unsafe.

"The mean-pressure, condensing engines, on Woolf's construction, are those which are made in the principal manufactory in France. With these engines the pressure may be varied from that of one atmosphere to two and a half, or three atmospheres, and is indicated by a mercurial gauge.

"The true boiler and boiling pipes in Woolf's engines (which must not be confounded) are made of the purest cast iron. The form of the boiler is cylindrical, its axis being horizontal.

"The thickness of the boilers and boiling pipes of large and small steam-engines, varies from about an inch and a quarter to an inch and three quarters. The diameter of the boiling pipes is much less than that of the boiler; for small engines it is less than half, for large engines less than one-third of the diameter of the boiler.

"The axes of the boiling pipes are parallel to the axis of the boiler; they are placed below it, and immediately over the fire-place, in such a way that the flame is in contact with the pipes only.

"As the boiler is less exposed to the fire than the pipes, it is less subject to injury from its action; and if any part give way from that cause, it is the lower part of the pipes, and not the boiler; the consequence of which is the inundation of the fire-place, and extinction of the fire, as happened in one of the accidents mentioned above.

"The parts of the engine are united with every possible attention to strength, and to closeness at the joints, so that there may be no loss of power from the escape of steam.

"Before the pipes and boiler are used, they are separately submitted, by a hydraulic press, to five times the pressure that they will have to support when the engine is at work.

"Before any conclusions are drawn from the preceding facts and observations, it may be well briefly to recapitulate them.

"High-pressure steam-engines are employed with most advantage.

"1st. Because the greater the compression of the steam, the less is the space the engine occupies.

"2d. Because it produces an equal power to that of a low-pressure engine, with a smaller quantity of fuel.

"But they are considered as more dangerous than low-pressure engines. Nevertheless, engines may be constructed, with which explosions, if not absolutely impossible, are at least extremely rare; and with which not a single instance of an explosion has occurred in France, since they have been used in that country.

"Such are the mean-pressure engines, of three or four atmospheres, made in France, on Woolfe's construction, as improved by Edwards, with boilers four or five times stronger than can be burst by the force of the steam which they have to resist.

"Such also are the high-pressure engines of 10 atmospheres, constructed on the plan of Oliver Evans, of the United States of America. With these engines the boiler is capable of resisting ten times the force it is daily subjected to.

"But engines constructed with less care, or managed with less prudence, have occasioned dreadful accidents, *especially in Great Britain.**

"In France only one accident has ever happened, by which any lives were lost, which were those of two individuals engaged in the service of the engine; and not one single instance has occurred in that country, in which any damage has been sustained by any individuals, from the explosion of a steam-engine on the adjoining premises.

"Although it appears, from the preceding statement, that no one in the neighbourhood of a steam-engine, in France, has ever suffered either in his person or property from any explosion, yet the impossibility of such consequences has not been proved; and the bare apprehension of the danger is a real evil, attendant on the erection of a mean or high-pressure steam-engine in the neighbourhood of a dwelling-house. To reduce that apprehension as much as pos-

* It results from the evidence given at the Coroner's Inquest, that the boiler was constructed on bad principles; and one gentleman said, had he known the way in which it was made, he would never have passed on that side of the street. It will indeed be a reproach to British skill if we are to be outdone in the construction of steam-boilers by the French.

sible the following precautions should be adopted.

"1. Every steam-engine boiler should be furnished with two safety valves, one of them inaccessible to the workman who attends the engine, the other under his command, in order that he may be able to diminish the pressure on it, as occasion may require. If he attempt to overload this valve, it will have no effect, since the steam will find vent through the other, which is out of his reach.

"The reporter, M. Dupin, suggests in this place, that if any apprehension of danger be entertained, from the possibility of the inaccessible valve becoming fixed by rust, or negligence, it may be obviated, by fixing in the upper part of the boiler two plugs of fusible metal, formed of such an alloy as to melt at a few degrees above the working temperature of the steam. One of these plugs is to be considerably larger than the other, and to be made of a rather less fusible alloy, so that if the steam does not escape with sufficient rapidity on the fusion of the smaller, it may have ample room to fly off, as soon as the larger has given way. The temperature, at which the least fusible alloy melts, must of course be considerably below that at which the increased elasticity of the steam would endanger the safety of the boiler.

"2. All the boilers should be proved by being submitted, by means of the hydraulic press, to four or five times the working pressure, for engines that work with a pressure of from two to four atmospheres. Beyond that term the proof pressure should as much exceed the working pressure, as the latter exceeds the simple pressure of the atmosphere.

"3. Every steam-engine maker should be obliged to make known his method of proving the boilers, as well as whatever may guarantee the solidity and safety of his engines, especially as regards the boiler and its appendages. He should also declare this working pressure, estimated by the number of atmospheres, or in pounds, on each square inch of surface exposed to the action of the steam.

"4. For further security, the boilers of very powerful engines, when near a dwelling-house, may be surrounded by a thick wall, at the distance of between three and four feet from the boiler, and at least as far from the party wall of the adjoining house."

It would seem from this, that the principal cause of the accidents in our country is, that the engines are not constructed with sufficient care. The accidents in France are comparatively few, and not one explosion has occurred with a single engine constructed on Mr. Evans's plan. It would seem, too, that the surest method of preventing accidents is to construct every boiler *with one certain part weaker than another*; (whether this is done as recommended by M. Dupin, by metals fusible at a certain temperature, or by any other means,) and then placing this weaker part of the boiler in that direction or situation where no injury can occur when it gives way.

ADULTERATION OF FOOD.

REMARKS ON ACCUM.

(*Continued from p. 157.*)

The next articles to which our attention is directed are not exactly under the denomination of "culinary poisons," but with his usual philanthropy, the author is determined that no class of tradesmen shall escape, at all events, a *suspicion* of dishonesty; and where it is not convenient to give particular instances of fraud, he very mercifully takes them *en masse*—I presume, in justice to his own character, that he may not incur a suspicion of favour or partiality: Ex. "Potatoes are soaked in water to augment their weight." "The inferior sorts of butter are frequently adulterated with hogs' lard." "In the manufacture of printing paper, a large quantity of plaster of Paris is often added to the paper stuff, to increase the weight of the manufactured article." "The selvage of cloth is often dyed with a permanent colour, and artfully stitched to the edge of cloth dyed with a fugitive dye." "The frauds committed in the tanning of skins, and in the manufacture of cutlery and jewellery *exceed belief*." It would be very amusing to ascertain the extent of Mr. Accum's credulity, and the standard by which he measures that of other people; but if the frauds are really so notorious, why has he not given us some information as to their nature, and, as his title page authorizes us to expect, "methods of detecting them." We are next introduced to the butcher, and the "poison" he administers arises from what is technically called "blowing," that

is, "inflating the meat by the breath respired from the lungs, to make it appear white and glistening." The following exquisite specimen of delicate sensibility must not be omitted:—"It is such a dirty trick that the very idea of it is sufficient to disgust a person at every thing which comes from a butcher's shop; for who can bear the notion of eating meat, the cellular substance of which has been filled with the air of a dirty fellow, who may at the time be perhaps afflicted with the very worst of diseases." Now the fact is, that the object of this process is not to make the meat appear "white and glistening," nor has it any such effect; the intention is simply to distend the skin in some particular parts, to afford a greater facility to the operator in separating it from the carcass. It is certainly not a very cleanly act, and might be easily accomplished in a less disagreeable way; but we do not expect to find the butchers the best examples of cleanliness, and it will be some consolation to those who are determined to fancy molehills mountains, and conjure up imaginary evils, to observe, that as far as appearance goes, they are as little likely to be "afilicted with the very worst diseases" as any class of tradesmen. The "method of detection" is, in this case, I fear, of little use; as I doubt whether any of our cooks or housekeepers are scientific enough to know what the cellular membrane means. Lest the sophisticating and adulterating propensities of the butcher should not be sufficient to disgust us, the author has thought proper to bring forward divers acts of cruelty against them, viz. "Keeping the animals without food for three or four days; suspending them by the hind legs for hours, and bleeding them to death slowly;" and "frequently breaking the leg of a *sheep*, because it is *untractable*."—The ridiculous absurdity of the last renders it unnecessary to deny the preceding. The next twenty pages are devoted to water; and even this very useful and necessary article cannot be depended on, for he says, (p. 46,) "Water perfectly pure is scarcely ever met with in nature." I shall leave Nature to defend herself from such a serious charge; perhaps the samples Mr. Accum tried were made by some of "Nature's journeymen, and not made properly." Then follows the wine merchant, against whom one charge only of a serious kind is brought, viz.—the use of lead. The others are comparatively of trifling importance, such as using artificial colouring matter, substituting home-made wines, and the practice of sometimes colouring the staves of the cask, to give the appearance of age to the contents. There is, however, in this chapter one circumstance which is very remarkable: in page 89 we are referred to Dr. Reece's "Gazette of Health," and the Supplement to the Pharmacopæia, for recipes for manufacturing "spurious wines;" and in page 98, on a quotation from Graham's "Treatise on Wine-making," Mr. Accum makes the following note: "This book, which has run through many editions, may be supposed to have done some harm"! How was it that the mischievous tendency of his own book did not occur to Mr. Accum when he wrote this? On the adulteration of bread, the letter of "A Baker," in a late Number, leaves little to be said; the only pernicious article mentioned is alum, and this Mr. Accum acknowledges is "rendered indispensable by the caprice of the consumer," and the injurious effects of which many medical men deny, from the minute quantity used, viz. eight or ten grains in a quartern loaf.*

ON COMBUSTION.

To the Editor of The Chemist.

Sir,—On looking over your back Numbers, I find in the 34th a communication from "Simon Pry,"

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* We are under the necessity of postponing the remainder of this communication till our next.

proposing a query for the consideration of your readers. "I wish to know," says he, "what particular circumstance it is which makes combustion, when it takes place in oxygen, previously separated from all other gases, so much more brilliant than when it takes place in the mixed atmosphere,—seeing that, in both cases, the combustion is merely an union of the combustible body with a certain quantity of oxygen?" "It is clear (continues he,) since combustion, whether taking place in the mixed atmosphere, or in the already separated oxygen gas, is merely an union of the combustible with a determinate quantity of oxygen, that the greater splendour and greater heat produced in one case than the other is not at present accounted for."

It appears to me, Mr. Editor, that your correspondent Simon Pure—I beg his pardon—Simon Pry, has entangled himself with a theory, and refuses to trust to the dictates of his judgment for his extrication. He would not think of inquiring how it is that a person who inhales nitrous oxide, or laughing gas, experiences a quicker circulation of blood, and a greater flow of animal spirits than he who breathes "the mixed atmosphere." I think, however, he will allow that these cases are analogous; "since it is clear" that the flow of animal spirits, "whether taking place" in consequence of the lungs inhaling "the mixed atmosphere, or the oxygen gas, already separated" from a part of its attendant nitrogen (as in the laughing gas,) "is merely an union of the" blood "with a determinate quantity of oxygen." If, as he states, the combustion of a body is dependent on its union with the oxygen of the atmosphere, it does not appear to me so very *unaccountable* that the greater the quantity of oxygen supplied, the more brilliant will be the flame produced.

It has been somewhere remarked, "that many persons are blessed with good sense, and great sense, and every other kind of sense, but common sense. He who carries nothing about him but sterling gold will find himself every day in want of ready change." If your correspondent Simon will but call into exercise a little of that valuable kind of sense last mentioned, I apprehend he will not find it so very difficult to be "accounted for," why combustion should be attended with less "splendour and heat," when it has to search for its food among a heap of rubbish than when its nourishment is supplied already prepared to hand,

——"unmixed with baser matter."

I am, Sir,
Your correspondent.

Dec. 18th. R. N.

DICTIONARY OF CHEMISTRY.

Eagle-stone, *clay iron stone.*

Earths. The different substances known in common language by the name of *earth*, as well as the earthy parts of all rocks and stones, were long ago shown by chemical analysis, to be only nine; and that to these nine all the earthy substances might be reduced. The nine were *baryta, strontita, lime, magnesia, alumina silica, glucina, zirconia, yttria*; and, only a few years ago these were all considered as simple substances, not likely ever to be decomposed. The discovery by Sir Humphry Davy of the metallic bases of the alkalies led chemists to suspect that these earths were also metallic oxides. Subsequent researches have established this conclusion as to several of them, and from analogy, therefore, it is now concluded that all the earths are metallic oxides. On this theory, the whole crust of the globe consists of different metals combined with oxygen.

Earthen Ware is made principally of two species of the above earths, alumina and silica, reduced to fine powder, intimately mixed, formed into vessels, baked, and glazed.

Ebullition. When fluids pass rapidly into vapour, some of the vapour forming beneath the surface agitates the liquid before it

bursts through it, and large bubbles are formed; in common language, this is *boiling*. As bodies are preserved in their present state by the pressure of the atmosphere, when this is removed or diminished, they pass more readily into vapour, and hence the alteration in the boiling points of liquid as the pressure is altered.

EFFERVESCENCE, like ebullition, is occasioned by some part of a substance (spontaneously) taking the form of vapour; it seems to differ from it in this spontaneity, and being generally the result of chemical action. It is a lesser kind of *bubbling*, producing froth.

EFFLORESCENCE. When salts fall into a dry powder, occasioned by losing the water of crystallization, they are said to effloresce.

EGERAN. A species of garnet found at Egar, in Bohemia.

EGGS are composed of several distinct parts: 1st, the shell, which consists of carbonate of lime, phosphate of lime, gelatine, and water; 2d, a thin, white, strong membrane, possessing the characteristics of animal substances; 3d, the white of the egg, or albumen; 4th, the yolk, which is apparently an oil mixed with serous matter. Yolk of egg is used to make resins and oils diffuse in water.

EISENRAHN. Scaly iron ore, and scaly manganese ore.

ELAIN. Solid fats have lately been separated into two distinct portions, the oily or fluid part of which has been called by its first discoverer, M. Chevreul, *elain*: the solid part he calls *stearine*. In The Chemist, No. IV., p. 56, we have given a method of separating these two substances from one another, and pointed out the utility of *elain* in all cases where oil is used to prevent friction.

ELAOLITE, *fettstein*. A species of *felspar*, consisting of 46.5 silica, 30.25 alumina, 0.75 lime, 18 potassa, 1 oxide of iron, 2 water.

TO SPEEDILY EXTINGUISH FLAME.

SIR,—The late calamitous fires have brought forth several suggestions for quickly extinguishing flame. The following I think will be found practicable and useful.—The power of carbonic acid gas in extinguishing flame is well known. I propose, then, to eject from one fire-engine a mixture of chalk and water, and from another diluted sulphuric acid, uniting the streams from the two engines as they enter the building, and this ought to be above the flame. A large quantity of carbonic acid gas will thus be produced, and would, I have no doubt, have a very sensible effect on the flames; beside which, the water would have the usual effect.

Carbonic acid gas, your readers will be generally aware, is that species of foul air, or choke damp, as it is called, which is found in vaults or cellars that have been some time shut up, and which has caused so many fatal accidents to persons entering them. It is a product of combustion, and immediately extinguishes a light if introduced into it, and flame of every kind, if no other air be present. By being thrown in above the flame it would flow downward to the burning body, on account of its specific gravity being much greater than atmospheric air. The expense would be very trifling.*

ANECDOTE OF THE ROYAL SOCIETY.

AT the Anniversary Meeting of the Mechanics' Institution, which took place a short time ago, Col. Torrens, who is a Member of the Royal Society, told the following anecdote; he adduced it as a proof of the liberality which science gives to the mind, and we beg leave to call the reader's attention to it, as a proof of the honours bestowed by these socie-

* The same suggestion of employing carbonic acid gas to extinguish fires has appeared in some of the Edinburgh Newspapers since the fire in that city, but the mode in which its application was proposed was not stated. The plan of our correspondent is, therefore, as far as we know, quite original; and that more than one person has thought of the same expedient is an additional argument in favour of its utility.

ties being sometimes injudiciously given:— At the last Anniversary of the Royal Society except one, Dr. Pond, the Astronomer Royal, announced, that the fixed stars had a parallax, which he took for a brilliant discovery; and the Society being of the same opinion, awarded him, by the hand of the President, Sir H. Davy, who warmly expatiated on the value of Dr. Pond's discovery, the Copleyian medal. At the late Anniversary of the Society, however, Mr. Brinkley, astronomer at Dublin, proved to the Royal Society that Dr. Pond's brilliant discovery was altogether an error; and for this he was also rewarded with the Copleyian medal. Dr. Pond, being a Member of the Royal Society, was the first to vote for bestowing this honour on his antagonist. This was unquestionably liberal of the individual, but what are we to think of the Society's penetration?

INFLUENCE OF METALS ON MAGNETISM.

(NEW DISCOVERY OF M. ARAGO.)

M. ARAGO has lately stated to the Academy of Sciences at Paris, that when a needle magnetized is made to oscillate in a space circumscribed by a *copper* circle it continues to oscillate for a shorter time than when made to oscillate in a space circumscribed by iron; so that the copper appears to have the effect of offering to the oscillations of the needle a medium of greater resistance.

ZINC PLATES FOR ENGRAVING.

IN Germany at present artists have begun to substitute zinc plates instead of copper plates, and also instead of stone for engravings. The artist draws on the zinc as on stone, and the expense of engraving is thus saved. A large work, being a collection of monuments of architecture, from zinc plates, has already appeared at Darmstadt, and is highly spoken of. The process is said to unite the economy of lithography with the clearness of copper engraving.

TO INFLAME GUNPOWDER BY ICE.

To the Editor of the Chemist.

MR. EDITOR,—I have already given you a specimen of the summer amusement of our boys; and with your permission I will now tell you of one of their winter frolics, though I am afraid the sun never shines powerfully enough in this foggy country, and certainly never does in this smoky metropolis, to allow of your readers imitating German boys. We used, I recollect, to take a considerable quantity of water, and boil it for about an hour, in order to get rid of the air, and then we froze it in the air. This ice was then put into a vessel, the bottom of which was made neatly and correctly concave, and allowed gradually to melt on the fire till it assumed the form of the vessel, and then it was again frozen. When one side was thus prepared, the other was then fashioned in the same way, which formed it into a lens. We then took hold of it, having gloves on, and holding it in the sun's rays on a clear winter's day, so as to collect the light into one point, were able to set fire to gunpowder. Sometimes, too, we cast for ourselves ice guns, and fired our powder in them by the help of our ice lens, practising these our philosophical boys' tricks to the annoyance of the neighbourhood.

I am, Sir,

Your old correspondent,

EIN DEUTSCHER.

London, Dec. 12.

TO CORRESPONDENTS.

"No Chemist" is informed, that the substances which make water *hard* are so numerous, it is not possible to say how, nor even whether, it can be purified, unless the contaminating substances are known.

"Inquisitas," the Index to the first Vol. of The Chemist has been published upwards of two months.

*** Communications (post paid) to be addressed to the Editor at the Publishers'.

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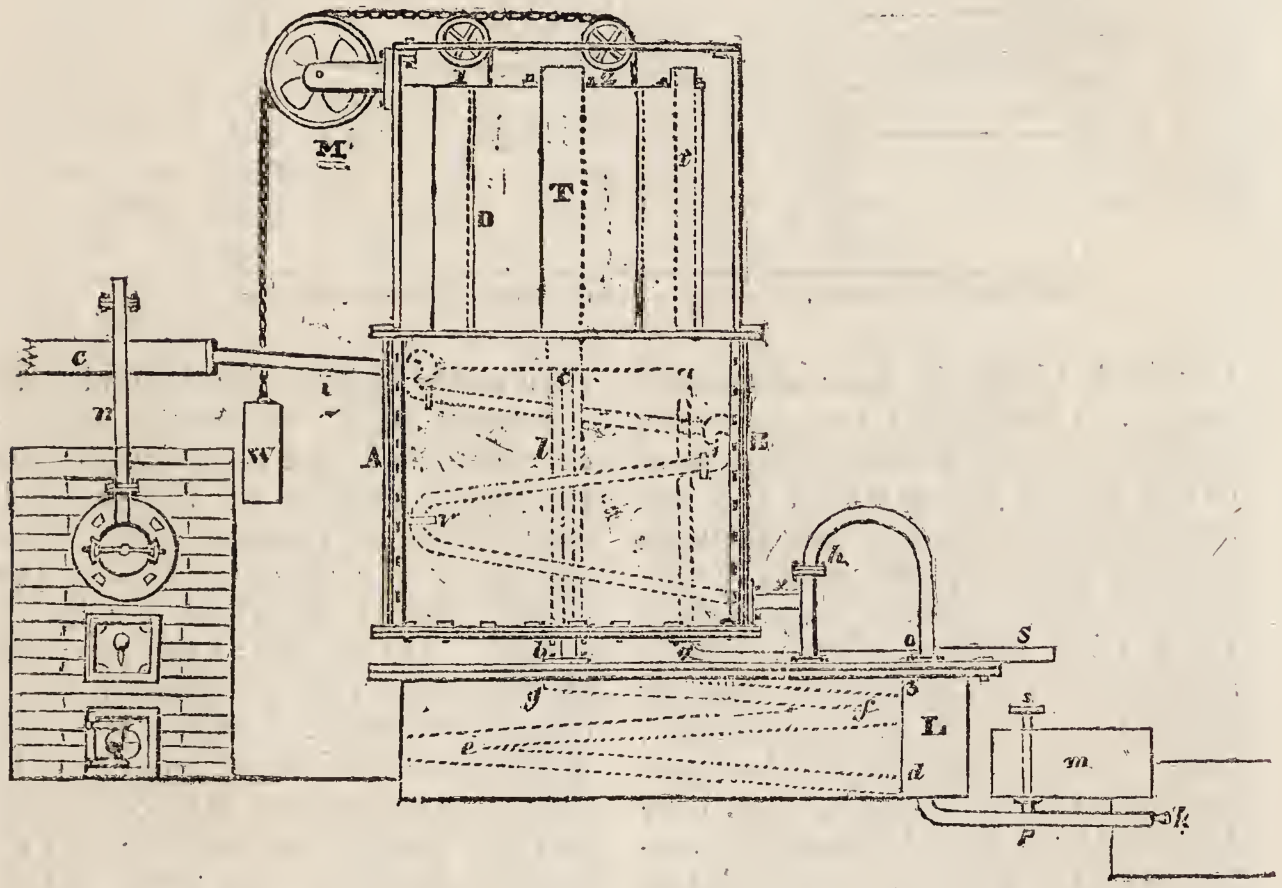

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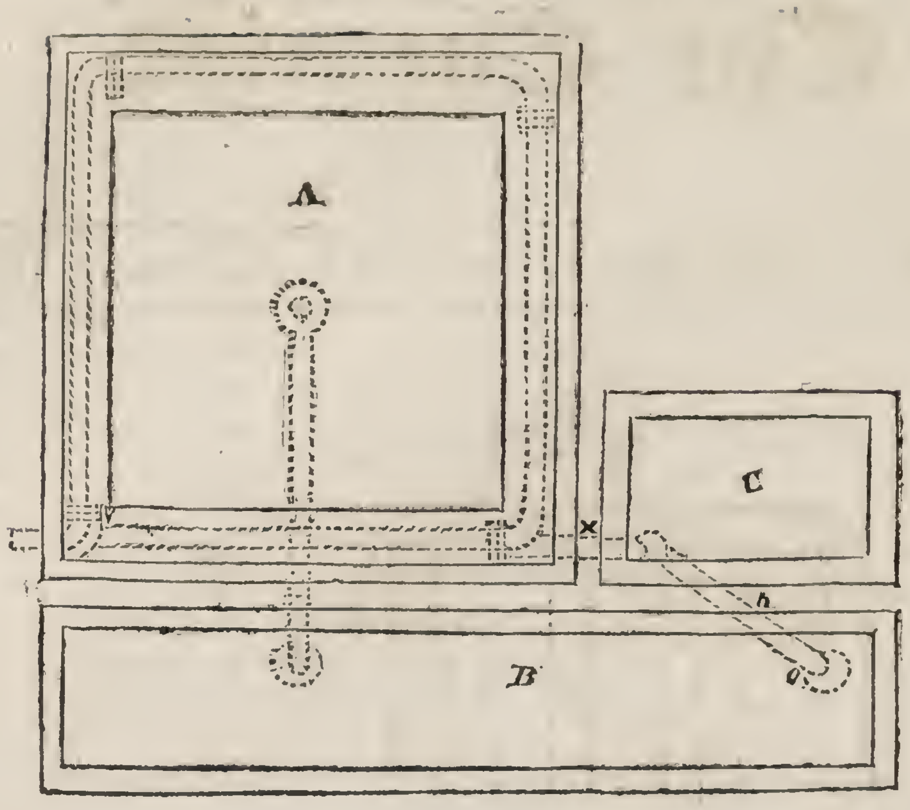
GAS LIGHTS.

Our plate this week represents a front elevation of the whole gas apparatus, with a plan of it. The large pipe, *c*, called the condenser, the place of which only was seen in



our last plate, is now distinctly shown. A portion of tar condenses in this pipe till it rises to the level of the pipe *i*, along which the gas and tar descend, passing through a succession of pipes round the inside of the vessel A B, which is filled with water. This vessel is square, so that the pipes passing along its sides are of equal length. They are inclined to the horizon, and come to the point *v*, when they have passed quite round the vessel, and the pipe *v x* extends to *x*; the further direction of this pipe is seen in the plan; it terminates in the vessel, which is called the tar vessel, and in it the tar and ammoniacal liquor are condensed and deposited. It is made perfectly air tight, and its contents can be drawn off at an aperture level with the bottom, so that no air can escape till the whole of the liquid is discharged. The vessel *m*, is a reservoir containing lime and water, and is of a certain depth, in order to fill L to a certain height. On drawing out the plug *s*, the lime and water passes from *m* into L; and when L is supplied, the plug is replaced. The gaseous products, after passing on to *x*, rise up through the pipe *h*, which, afterwards descending, enters the lime vessel L at *o*. The lime water, which stood level with the top of *m*, is, by the gas, pressed down to *d*, and forced along the passage *d e f g* to *g*; the gas follows the same course, and enters the pipe *b c* at *g*, and also the larger pipe *l*, in which *b c* is inclosed. *l* is closed at the top; but at the point *l* is perforated by a number of holes. A B is filled with water up to the lower extremity of the inner gasometer D. When the gas has passed out of the top of *b c*, it displaces the water in *l*, which is level with that in A B, till it sinks to *l*, when it escapes at the holes, and bubbles up through the water. In this state it is preserved in the gasometer D, and is fit for use.

The cavity, *d e f g*, of the lime vessel, L, is formed by six plates of iron, lead, or wood, of the width of L. They are arranged in pairs, parallel to each other, forming cells, which contain a stratum of fluid three inches thick, fifteen wide, and of a length equal to *d e*, added to *e f* and *f g*. This cavity, and the space L, constitute the whole capacity of this vessel, the remainder being excluded by the the partition, 3.*d*, and the zig-zag cavity.

The gasometer consists of an outer vessel, A B, made of cast

iron plates screwed together by flanges, and filled with water. D is made of plate iron, the plates being united with rivets. This vessel in an inverted position falls and rises in the outer vessel, as more or less gas is impelled in it. It is suspended by chains over the pullies 1 2. The ends of both these chains are fastened in separate grooves in the edge of the pulley M, which is of such a diameter that the vessel D rises to its full height before the pulley makes one revolution. In another groove in the edge of the pulley M is fastened the end of a second chain, to which the weight W is suspended. This weight is nearly equal to the weight of the vessel D, and assists it in rising as the gas comes under it. When the whole of D is immersed in water, it loses weight equal to its own bulk of water. The vessel will therefore increase in weight as it rises higher, and will require a heavier counterpoise. This is effected by forming the groove in the pulley M, which contains the weight-chain, so as to make the radii of the wheel change reciprocally with the relative weight of the vessel D, so that it is uniform in its ascent and descent. Before the gas is admitted, D is made to descend quite to the bottom, by opening the stop cock *y*, in the pipe *z q y*, which opens into the gasometer above the water. On the common air being expelled, and its place occupied by water, *y* is shut and the gasometer is ready.

After the gas has been purified in the lime vessel, and has risen through *b c*, on opening the cock *y* the preponderating weight of D forces the gas through *z q y*, when it is conveyed to the spot where it is to be burnt. T *t* are pipes firmly inserted into the top of D; and in their motion up and down constantly envelop *b c* and *q z*, and they serve to keep D steady in its motion upwards and downwards. The part of each projecting above D forms a recess for the ends of *b c* and *z q*, so that their mouths may be above the water, when the roof of D comes to the surface, which serves to expel the whole of the common air at the commencement. Of course the water in A B, and the lime water in L, require frequent changing, particularly the latter, as the lime is very soon saturated with the carbonic acid, sulphuretted hydrogen, and sulphurous acid, which come over with the carburetted hydrogen, and it should be changed before saturation. The mixture of lime and water is about the thickness of cream, and is called cream of lime. When the liquid in L is to be changed, the plug *k* is taken out; and when it is emptied, and the plug replaced, a fresh supply is obtained from *m*.

(*To be continued.*)

TEST FOR HYDROCYANIC ACID.

A SINGLE drop of hydrocyanic (Prussic) acid, it is stated by Mr. Brande in his Lectures, placed on the tongue, kills a strong animal, as if it were struck dead by lightning. So instantaneous is the effect, that the heart continues to beat after respiration has ceased. At the same time it is so volatile and liable to decomposition, that it has been doubted by physiologists if it would be possible to trace its existence in the body of an animal or of a person poisoned by it, a short time after death; and if this doubt were well founded, hydrocyanic acid would be the most powerful means of mischief ever placed within the reach of an assassin. To detect it, the following method is recommended by M. Lassaigne, and approved of by those enlightened chemists, Thenard, Vauquelin, and Magendie, in a report lately made to the Institute. The liquid suspected of containing hydrocyanic acid, is rendered slightly alkaline by potash. A few drops of sulphate of copper are then let fall, and afterwards a sufficient quantity of hydro-chloric acid is added to re-dissolve the oxide of copper. The liquor immediately assumes a milky appearance, owing to the cyanogen uniting with the

copper, more or less intensely, according to the quantity of hydrocyanic acid it contains. After some hours the precipitate is again re-dissolved, particularly if the liquid contains an excess of hydrochloric acid. When the hydrocyanic acid is in a greater proportion than 1-20,000th of the water, the cyanure of copper is precipitated in white flakes, and is not re-dissolved for some days. In the experiments made on this subject by M. Lassaigne, the liquid employed was water, with acid dissolved in it; and in this case he succeeded in detecting, by means of sulphate of copper, a proportion of acid not exceeding the 20,000th part of the whole. When the proportion of acid is very small, its presence is not made sensible by employing the sulphate of iron, till at the end of twelve or sixteen hours, while the sulphate of copper detected it instantly, and the precipitate it caused was sometimes re-dissolved before the sulphate of iron had produced any effect.

MAKING SOUP FROM BONES.

At the hospital of Montpellier the following economical process is adopted. The bones are broken into pieces of an inch or an inch and half long, and with them a coarse earthenware pot is about two-thirds filled. The pot is then filled with water, covered by a lid also made of coarse earthenware, and put into the oven when the bread is taken out. It remains four hours, and at the end of that time a good gelatinous nourishing *bouillon* is obtained, which is poured off. The pot with the same bones is again filled with water; and after being in the oven six hours, another bouillon is poured off, which is not quite so good as the first. The bones are still left in the pot, and it is filled with water for the third time; and after being in the oven eight hours, a third bouillon is procured, which, though not so good as either of the others, is still a very good bouillon.—Treated in this way, about 13½ lbs. of bones, which had not before been cooked, gave in all 50 lbs. of *bouillon*, which, when seasoned and thickened with vegetables and bread, made soup for 440 sick persons.

ELECTRICAL BOTTLE.

To the Editor of the Chemist.

Sir,—I think it immaterial what sized iron turnings are used for the electrical bottles. I get mine from engine makers, and give at the rate of 8*s*. per cwt. for them, or 1*s*. for 14lb. I conceive that small nails or small scraps of iron would answer the purpose, but I use the iron turnings because they are to be had at a cheaper rate than any other small pieces of metal. I use them also for the production of hydrogen gas. It will be understood, then, that the shape and size of the iron fragments are of little consequence, the water not only answering the purpose of *a smooth surface* to the inner coating, but also that of retaining the electricity till a communication is made with the outer coating.

I perceive you have omitted the word *new*, in my communication respecting the electrical bottle: I had called the bottle my *new* acquaintance, as it would not become a *philosopher* to profess an acquaintance with the bottle, in its usual acceptation.

I may probably trouble you again shortly.

I am, Sir,
Your obedient servant,
Dec. 23. Tyro Chemicus.

EXTINGUISHING FLAME BY CARBONIC ACID GAS.

To the Editor of the Chemist.

Sir,—In your last Number a Correspondent has given a plan for the "quickly extinguishing flame," which is, "to eject from one fire-engine a mixture of chalk and water, and from another diluted sulphuric acid, uniting the streams from the two engines as they enter the building."

There appears to me several insurmountable objections to this plan. 1stly, None of the firemen

would approach the building on fire, whilst such a dangerous shower was descending; their exertions, consequently, would be rendered nugatory. 2dly, The danger arising from carrying so large a quantity of oil of vitriol about, as must necessarily be the case; and, 3dly, the corrosive action of the acid on the engine and pipes. Could these objections be overcome, the difficulty of apportioning the acid to the water would be sufficient to prevent its adoption.

There is no novelty in the suggestion of employing chalk with the water thrown on fire, as the learned Dr. Thornton recommended to me, several years ago, the use of that article as a more effectual means of extinguishing fire.

Not being a chemist, I would inquire whether the carbonic acid gas would not be liberated when the chalk was thrown on the fire in so finely a divided state; if so, the sulphuric acid, as recommended by your Correspondent, would be useless.

I am, Sir,
Your obedient servant,
Dec. 27. F. S.

A SOUR STREAM.

An old woman, whose son was a sailor, having been told by her dutiful offspring of all the wonders he had seen in his voyage, is said to have replied, she could believe there might be rivers of rum and mountains of sugar, but could not possibly credit the story of the flying-fish. Alas for her discernment! The wonders of Nature are infinite, and the produce of man's labour limited, and not greater than his wants. Her scepticism and her credulity were alike wrong: sugar and rum are made or extracted by art, and have never been found in any superfluous quantities; while the tropical seas abound in fish which fly. As vinegar is also in general a product of art, we may expect hardly to be credited when we state that there are rivers which are so sour as to be called rivers of vinegar, the natives being acquainted with no other acid. There is such a one in the Andes of Popayan, in South America, and near the road from Bogota to Quito. It is mentioned by the celebrated traveller Baron Humboldt, and has its source at a very considerable height, and in the neighbourhood of two volcanoes. It is a warm spring, or has a temperature considerably above that of the atmosphere. Its waters have been lately analyzed by M. Rivero, and found to contain per *litre*, 1.080 *grammes* of sulphuric acid, 0.184 muriatic acid, 0.240 alumina, 0.160 lime, with some traces of iron.

ADULTERATION OF COCHINEAL.

There are two species of cochineal known in commerce, one called black, the other grey; and the difference in the two is attributed to a different mode of procuring the insect. The black cochineal is obtained by plunging the insects in a net into boiling water, and afterwards drying them; the grey cochineal is obtained by spreading the insects on hurdles, and afterwards drying them by the fire. The latter have a silvery appearance, which has probably been the cause why they are preferred, as otherwise they are not superior to the black cochineal. This preference, however, creating a larger demand for them than the others, has led some persons to convert the black into the grey by an artificial process. M. Boutron Charlard says he had long suspected that this was the case, owing to having found a white substance at the bottom of vessels containing cochineal; and he accordingly procured several parcels from different houses in Paris, which he examined. By shaking them, or scraping them with a small steel instrument, he succeeded in separating from the grey cochineal a considerable quantity of a soapy white powder, which he ascertained was Venetian talc, and which, by its mother of pearl appearance, is well adapted to this species of fraud.

When M. Boutron Charlard had

ascertained this point, he set about finding out the means employed to accomplish it. The black cochineal, he says, is first exposed in a damp cellar for 36 or 48 hours, and the humidity it thus absorbs is sufficient to make the talc adhere, and impart to the black cochineal its silvery hue. The cochineal is then shaken in a leather bag with a quantity of Venetian talc, reduced to fine powder; it is then dried and sifted, and is thus sent to market.—*Bulletin des Sciences Technologiques.*

TITANIUM.

Dr. Walchner has discovered among the products of the forges in Baden, and in the midst of an oxide of iron, some small cubical crystals, of a red-yellow colour, something between copper and gold, which he has ascertained to be pure titanium, similar to that described by Dr. Wollaston in the Philosophical Transactions. He found that the iron used in the furnaces contained oxide of titanium. —*Neues Jour. fur Chemie.*

STATE OF PARIS.

From the various tables of population, it appears that, since the great political commotion of 1789, the population of Paris has increased in the proportion of about 212 to 200; that there have been constantly arriving (especially since the Revolution) a number of foreigners in that capital, who have died there; that within 30 years the number of marriages has increased about a sixteenth; and that the number of foundlings has diminished more than a fourth; on the other hand, it appears that the number of natural children has been increasing since 1806; before which time there are no certain accounts, as natural children and legitimate children were confounded in the registers. The number of natural children acknowledged by their parents was, in 1819 and 1820, about 21 in 54; in 1821, 21 in 71, being almost two-fifths less. The number of aids afforded by the charitable institutions were, in 1819, 85,150; in 1820, 86,870; that of admission into hospitals and asylums (reckoning the foundlings) in 1819, 77,513; in 1820, 80,031. The average deaths in the hospitals and asylums were about 1 in 7; the average expense for every individual received into them, from 110 to 123 francs a year. The number of indigent females is more than half as large again as that of indigent males.

It appears that, on the average, the annual expense for bread of every inhabitant of Paris is about 58 francs 64 centimes; of every family, 171 francs 21 centimes. It appears, also, that the average annual value of cattle sold, during the last ten years, in the markets of Seeaux, Paris, and Poissy, has been above 30 millions of francs in oxen; above 12 millions in cows; five millions and a quarter in calves; and near nine millions in sheep. The average price of the first of the above classes of animals has been 301 francs 90 centimes; of the second, 179 francs 9 centimes; of the third, 67 francs 11 centimes; and of the last, 21 francs 21 centimes.

The following details are as curious, though less important:— Paris contains 9761 shops for the sale of provisions, not including 5000 traders that way in the halls and in the streets. The venders of wine alone are 2333 in number; while there are but 560 bakers, 355 butchers, 927 eating-houses, and 787 coffee-houses. Thus it appears that the number of taverns is above four times that of bake-houses, and above six times that of butchers' shops. It ought to be observed, however, that the last must not exceed a certain number.

From the year 1810 to the year 1821 the number of silk manufactories increased from 52 to 67. In the year 1819, there was stamped in France, 6 millions of gold and silver articles, representing a value of 64 millions of francs. It is calculated that the gold manufactured in France, in 1819, amounted to thirty-eight hundredths of the gold annually brought into Europe. One

year with another, 120,000 watches and 15,000 clocks are sold in Paris, for about 20 millions of francs; the net profit on which is about 3 millions and a half.

680 presses are actively employed in Paris, and from 3 to 4000 printers. It is estimated, that of every hundred works published, 68 relate to the belles-lettres, history or politics; 20 to the sciences and the arts; and 12 to theology and jurisprudence. The average price of a thousand copies of a printed sheet, paper included, is 62 francs. The annual consumption of paper is 356,000 reams, &c. —*Revue Encyclopedique.*

LECTURES AT THE ROYAL INSTITUTION.

HYDROGEN.

LECTURE 17. In my last Lecture, Mr. Brande said, I explained to you the mode of procuring hydrogen, and showed that it is generally obtained from water. It can be procured from a number of animal and vegetable substances, but is then seldom pure; and it is from the decomposition of water, by some means or other, that it is obtained in the greatest purity. From experiments lately made with great care, and which seem to merit confidence, 100 cubic inches of hydrogen weigh 2.118 grains, or rather more than 2 and 1-10th; compared with air, its specific gravity is as .0702 to 1.0000. It is the lightest body we are acquainted with; and in the scale of chemical equivalents it is assumed as unity, and is therefore represented by 1. In the Manual which I published as a text book for these lectures, the weight of 100 cubic inches of hydrogen is stated at 2.25, which is therefore somewhat too high, and of course all the specific gravities of other gases in relation to hydrogen are there stated too low. Instead of oxygen being as 15 to 1, it is 16 to 1; and chlorine, instead of being as 33 to 1, is as 36 to 1. It is only, however, in relation to hydrogen that the specific gravities of the tables are wrong; in the other relations, as, for example, that between chlorine and oxygen, they will be found correct.*

In consequence of the comparative lightness of hydrogen, it may be preserved for a short time in an inverted jar, without mixing with the common air, while, if the jar be kept with its mouth upwards, it almost instantly escapes, and common air supplies its place. It would lead to mistakes, however, to suppose that the hydrogen gas might be kept for any great length of time without mixing with the air. It has been shown by Mr. Dalton that all gases have a remarkable tendency to mix with each other. Thus, if we take two jars, one containing hydrogen and the other oxygen, and place the latter on a table with the mouth upwards, and the former above it with its mouth downwards, and connect both with a glass tube of small bore, so that no atmospheric air can find admission, we shall find that in a few hours the oxygen and hydrogen will be equally diffused throughout both the tube and the jars. According to Mr. Dalton's phraseology, the gases form vacua for each other; this expression will be understood after the explanation I have now given to you.

I have already mentioned to you that hydrogen mixed with atmospheric air or oxygen, and exposed to flame, explodes with considerable violence, and a loud detonation. On this principle the ELECTRICAL AIR GUN is constructed. It consists of a cylinder of brass about six inches long, and in the form of a small cannon or pistol barrel. But

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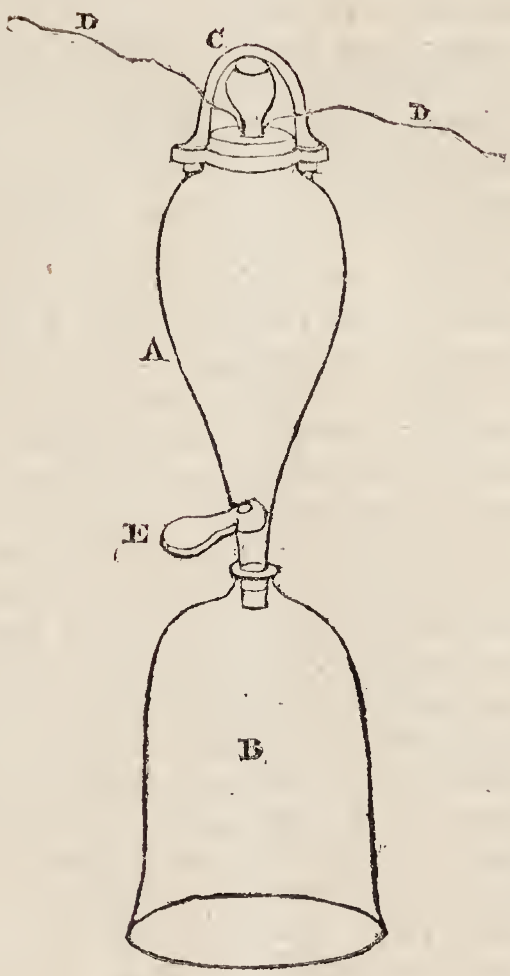
* This recent alteration in the statement of the weight and specific gravity of hydrogen, explains the source of the discrepancy which we noticed some time ago in Mr. Cooper's lecture. But why did that gentleman not state accurately, in the first instance, the true specific gravity of hydrogen? And why did Mr. Brande, in the beginning of his course, call the specific gravity of oxygen 15. The second edition of the Manual was published in 1821, and in that the weight of hydrogen is called 2.25.

we have already described this instrument, (see page 169,) and shall therefore here only add, that after the Professor had loaded it by filling it with dry sand, and then emptying it, that he communicated an electric spark to it, and the cork was expelled with much violence, and a loud report. To obtain the spark, a Leyden phial was held for a short time to the conductor of an electrical machine, and a few turns given to it.

Another curious property of hydrogen is that of producing very loud musical tones when inflamed at a small aperture, and made to pass through glass or earthen-ware tubes of different dimensions, the sound varying according to the thickness of the tube and the diameter of its bore. This effect, however, is not peculiar to hydrogen, but belongs to a variety of other flames, and is most probably occasioned by a succession of explosions, produced by the combustion of the gas, which makes the tubes vibrate, and thus produces sound. Nothing more is necessary to make this experiment than to place some zinc or iron filings along with diluted sulphuric acid, in a small bottle having a narrow mouth, or a narrow tube adapted to it, (as in page 169.) Set fire to the hydrogen gas as it issues, and hold over the flame glass tubes of different diameters, allowing the flame to pass through them. This experiment was performed, and tones of different intensity and force, resembling almost the tones of an organ, were produced.

One of the principal uses to which hydrogen gas has been put is that of filling air balloons, though, in consequence of being cheaper, coal gas is now generally employed. This is, however, much heavier, and requires that the balloon should be much larger to carry up an equal weight. The Professor filled a bladder with hydrogen gas from a gasometer, and on allowing the little thing to escape, it instantly flew up to the ceiling and remained there, playing about against it. Volta employed hydrogen to make a lamp to give instantaneous light. It consisted of a gasometer or reservoir below, containing hydrogen, to which a tube is attached with a stop cock and an electrophorus; on the top of the hydrogen reservoir is a reservoir of water connected with the one below by a narrow aperture, and also connected with the stop cock. On turning the cock, the water falls into the gas reservoir and forces out a stream, while the electrophorus, furnishing an electrical spark, ignites the gas. If the electrophorus be properly constructed, this lamp will last a considerable time, and the only trouble it requires is to be occasionally filled with hydrogen. It is also necessary to keep it in a dry room where there is a fire, or at least in a room not subject to dampness, and then it may be preserved in order a long time. The lamp exhibited was on the original plan of Volta, but they are now made, Mr. Brande said, of smaller dimensions, and are wholly inclosed in wood.

Mr. Brande then proceeded to treat of the combination of hydrogen with the substances previously treated of. With oxygen hydrogen forms water; I shall show you this fact, both by synthesis and analysis. If this stream of hydrogen, which I before employed to show you the effect of burning hydrogen in glass tubes, be made to burn within an inverted glass globe, the globe is very soon covered with moisture; and if the combustion is continued long enough, water will at length drop down its interior surface. A better way of showing this effect, and of collecting the water, is an apparatus, consisting of a funnel, and a glass cylinder, with an aperture at the end, opposite the funnel, to carry off the air which is not consumed. If we set fire to a stream of hydrogen as it passes into the funnel, it will unite with the oxygen of the atmosphere and form water, which will condense in the cylinder. This experiment was



first made by the French chemist, Margraf, and was afterwards repeated by Lavoisier, but was not understood. It was supposed that the moisture condensed on the glass was vapour, carried up by the flame from the liquid from which the hydrogen was produced; and it was Mr. Cavendish who first drew a different conclusion, and taught us that the vapour was occasioned by the formation of water. He burnt hydrogen mixed with common air and with oxygen, and found that it exploded and formed water. The Professor here exhibited the instrument with which Mr. Cavendish had originally made his experiments, which he was enabled to do (he said) by the kindness of Sir H. Davy. From these experiments it results that two measures of hydrogen and one of oxygen combine to form water. If these two gases be mixed in this proportion, and detonated by an electric spark, the gases will disappear, and a quantity of water will be found, precisely equal in weight to the two gases employed. This experiment may be thus performed:—A is a very strong glass vessel, with a glass stop cock E, and a ground glass stopper firmly secured by the wire C, through which the platinum wires D D pass. The vessel A being exhausted over the air pump, is fixed on the bell glass B, previously filled with a mixture of oxygen and hydrogen in the requisite proportions. On opening E, a quantity of the mixed gases passes into A; where, after carefully closing the stop cock, it is inflamed by the electric spark, passed through the platinum wires. At the

instant I apply the spark, the mixture detonates, and you see a vivid flame pervades the vessel above the stop cock, and it becomes lined with moisture. If the stop cock be again opened, a fresh portion of the gas enters, and may again be exploded. You must, however, take care not to use this apparatus till it has been well proved, as it is subject to a great force, and if not sufficiently strong, will be blown to pieces, and cause much mischief. When hydrogen is burnt in common air, the product has sometimes a sour taste, which depends on another element of the atmosphere, to be afterwards mentioned. When hydrogen, however, is burnt in pure oxygen, and in proper proportions, pure water is the result.

Water may be decomposed by a variety of means; the most common, and that which is usually resorted to for the sake of the hydrogen, is to subject it to the action of some metal in conjunction with an acid. The metals, however, which act with acids are only active with it, while there are others which decompose water without an acid, and act instantly. A piece of potassa thrown into water decomposes it immediately, combining with the oxygen, and forming an oxide of potassa, while the hydrogen escapes, and may be received in a glass jar standing over water. For every two volumes of hydrogen disengaged, one volume of oxygen is combined with the potassa. Another method of decomposing water is that invented by Lavoisier, and consists in making the vapour of water pass over some iron turnings through a tube heated red hot. After the experiment, it will be found that the iron has increased in weight; and if this weight be added to that of the hydrogen which has passed over, the two will be found equal to the weight of the water which has been decomposed. From an experiment of this kind, Lavoisier concluded, that 100 parts of water was composed of 88.8 of oxygen and 11 and 2 tenths of hydrogen. The composition of water then is thus represented:

ox.
hy. | 8
1 | 9 water

When it was supposed that air balloons might be made use of for purposes of war, an establishment for procuring hydrogen gas by this method was formed at Verdun, and the water was decomposed by being made to pass through gun barrels. After exhibiting the Lavoisierian method of decomposing water, the Professor decomposed it by Voltaic electricity, which he remarked was the best manner of effecting this, as both the products were then obtained in a gaseous state. We have so lately described this mode that we shall not now repeat it; and only remark, that the Professor observed, after the water is thus decomposed we may mix the gases, and fire them with the electric spark, thus composing and decomposing water alternately without the intervention of any *material agent*.*

Water in its ordinary state is generally contaminated with other substances which it holds in solution. Rain water, however, and water from melted snow or ice, is tolerably pure. The water of springs differs very much, as might be expected, from the different strata it flows through. The land springs, as they are termed, about London, or those which come from only a short distance, are much contaminated, while those which rise from the sand strata, or from the chalk strata, are very pure.† To obtain

* There is a well known theory of metaphysics which supposes that matter is only a general term for all our sensations. We do not know whether or not this theory has ever been much illustrated by the phenomena of chemistry and electricity; but it certainly seems, from this and other facts we have recorded, to be susceptible of illustration by these sciences.

† This chemical fact is of some importance at present, because there is a project on foot to supply all London with water by deep boring, which promises

water pure for chemical purposes, it is generally necessary to distil it; and pure distilled water is found to be vapid and tasteless. The taste of water, then, is owing to the substances it holds in solution, and principally to air, which it almost always contains. Even distilled water, however, contains traces of foreign matter; and it is not considered to be quite pure till it has been redistilled at a low temperature in silver vessels.

Water, when pure, is assumed as the standard for the weights of other bodies, its specific gravity being assumed as equal to 1.000. It is of some consequence therefore that its weight should be precisely known. At the temperature of 40 it is at its maximum of density, and a cubic foot then weighs 999,0914161 ounces avoirdupois, a cubic inch weighs 252.953 grains. At the temperature of 212, water is converted into vapour, which is considerably lighter than air. If air be considered as = 1, the specific gravity of vapour is 0.6218; compared to hydrogen, it is 9 to 1. At the temperature of 32°, water crystallizes, and becomes solid, forming ice, the specific gravity of which water being 1, is 0.94.

Water enters into various combinations, which will be hereafter considered; at present I shall only remark, that it enters into combination with dry salts, forming what is called the water of crystallization, and, with other solid substances, which are then called *hydrates*. In the dry sulphate of soda, for every 72 parts of salt, there is 90 parts of water; and in sulphate of magnesia, for every 60 parts of salt there is 63 parts of water. It must in these cases be considered as one of the constituents of the bodies, for it exists in them in definite proportions. Water is capable of absorbing considerable quantities of the different gases and of common air; and in general, as may be shown by boiling it, or placing it in the receiver of an air pump, it contains air. River water, and the waters of the ocean, give out more oxygen than other waters. When water has been wholly freed from air for chemical experiments, care must be taken not to expose it to the atmosphere for even a short period, as it almost instantly absorbs some air.

As hydrogen is the lightest body known, it is assumed as unity in reference to the weights of other bodies; and I am now to explain to you the doctrine of chemical equivalents or proportionals, which I purposely deferred to the present occasion. It has already been explained to you that it is assumed as a principle, and found to be correct in fact, that the respective quantities of any two bodies, each of which is necessary to saturate a third body, may be considered as equivalents. On this principle, the quantity of oxygen which saturates hydrogen is the half of its volume. And the latter being 16 times heavier than the former, its equivalent number is the half of this, or 8. A volume of hydrogen is saturated by an equal volume of chlorine in the composition of muriatic acid; and it being 36 times heavier than hydrogen, its equivalent is 36; the equivalent of iodine is deduced from the composition of the hydriodic acid, and is 125. These equivalent numbers have been by some persons supposed to represent the weight of an atom of the different substances; but this involves a theory, and I wish only to direct your attention to the proportional relations for which these numbers stand. I do not call them, therefore, atomic weights, but equivalent numbers. Of the compounds, of which I have already treated, the equivalent numbers are as follows: — Water, composed of 1 proportional hydrogen and 1 of oxygen, = 8, is 9; euchlorine, composed of 4 oxygen, = 32, and 1 chlorine, = 36, is 68; chloric acid, composed of 5 oxygen, = 40, and 1 chlorine, is 76; perchloric acid oxygen, 7 proportionals, = 56, chlorine 1, = 36, is 92; oxiodic acid, composed of 5 ox-

therefore to give us not only a greater abundance of water but of a better quality.

ygen, $=40$, and one iodine, $=125$, is 165; chloriodic acid, composed of 1 chlorine, $=36$, and 1 iodine, $=125$, is 161; muriatic acid, to be treated of hereafter, and composed of 1 proportional hydrogen and 1 chlorine, is 37. Some chemists have assumed oxygen as unity, but to this there is a considerable objection. As it is not the lightest body, we cannot describe bodies lighter than it, but by fractional numbers, which, going through all their compounds, makes much unnecessary complexity. I prefer, therefore the table of equivalents, which is founded on the assumption of hydrogen as unity, and this system is now generally adopted by chemists. Some tables, however, are still constructed on the basis of oxygen being the unity of the scale. Mr. Brande concluded his lecture by announcing that in his next he should treat of Muriatic Acid.

MERCURY IN SALT.

If Mr. Accum had been aware of the following fact, we have no doubt he would have cried out against Nature for adulterating the seasoning of our food. Perhaps, for he seems to have loved to vilify, he might have said she wished to poison us all, and was a wholesale murderess. Only think, reader, what a wicked jade! she puts *mercury* in our salt. Neither the bakers nor the butchers use half so deleterious a material. Pursuing her own malevolent views, she has not cared though she kept every eater of salt, which is a huge description, and comprises nearly every son and daughter of Adam, in a state of continued salivation. But to the proof of her cupidity and baseness, which we take from a foreign journal:—"Boyle, Stahl, Athanasius, Glauber, Kircher, and many other celebrated chemists, have conjectured that common salt contained mercury. Hilary Rouelle published, in 1777, that he had found marks of an amalgam on the sides of a silver vessel in which sea water had been distilled, and that the salt which he extracted, treated with sulphuric acid, had given a mercurial deposit in the neck of the retort. Fifteen years afterwards, Westrumb, by treating the salt obtained from the springs of Pyrmont with concentrated sulphuric acid, obtained a product which sublimed over, that contained both mercury and iron. Proust and Scherer have been led to the same conclusion. M. Wurzer having lately prepared some muriatic acid from salt, procured from various sources in Germany, has also obtained a volatile product, containing mercury and iron. This subject, he thinks, and so do we, is worthy of the attention of chemists. He proposes, as M. Proust has previously proposed, that a leaf of gold should be fixed to the keel of a ship, to ascertain if it would not, at the end of a long voyage, be covered with mercury. Should this turn out to be the case, the ships of Britain will be literally a mine of wealth, and our countrymen, we are afraid, will laud that Nature which enriches though she poison them.

TO MAKE INDIAN INK.

Take 6 parts by weight of isinglass, and dissolve it in double its weight of boiling water; dissolve also 1 part of Spanish liquorice in 2 parts by weight of water; mix the two liquids while they are hot, and incorporate with them gradually 1 part by weight of the best ivory black, stirring the mixture so as to make it perfectly uniform and homogeneous. When the ivory black has been all stirred in, evaporate the water gradually, by placing the vessel containing the mixture in a water bath; the paste which remains may be pressed into any form, and is quite as good as the ink brought from China.

HOUSES ROOFED WITH ZINC.

At Iserlohn, in Arnsberg, Prussia, zinc is now made into plates, and sold at the rate of 20 rix thalers (about 3*l.*) for 100lb. Roofs are made of these plates, which are so light that wood need not be above half so strong as for tiles or

slates, and on the whole, zinc roofs cost as little as roofs made of slate. The same thing is done in Poland; and there roofs are also constructed of paper made of straw, and steeped in tar and quick lime. The former makes the paper water-tight, the latter prevents it from being combustible.

TO MAKE GOOD COFFEE OUT OF RYE.

The rye is to be well cleaned, and then boiled till it is soft; but care is to be taken that it does not burst. It is afterwards to be dried in the sun, or in an oven, and then burnt like coffee, and when ground is fit for use. It may be infused and boiled in the usual way; but if coffee equal to Mocha is required, half of this powder mixed with half its weight of real coffee, gives a beverage fit for the Grand Turk, or to be served to the guests at the Caffé Hamblin of the Palais Royale.

TO MAKE BURSTS OF FLAME ON WATER.

Fill a small retort with water acidulated by muriatic acid, and put in it a quantity of phosphuret of lime in lumps; plunge the beak of the retort under water, and in a short time a gas is abundantly produced, which catches fire the instant it reaches the atmosphere, exhibiting a constant succession of flames on the surface of the water.

ORNAMENTS IN TIN FOIL.

To the Editor of The Chemist.

Sir,—As some of your readers (many of them being ladies) would like to know how to use tin, so as to have the appearance which is given to fire boxes, pillars which support the beams in many of the principal shops in the city, &c. &c. I send them a method of doing this, by which they may with ease form a variety of ornaments. Tin foil must be made quite smooth, and fastened on the work, whatever it be, with thin glue or strong gum water; when dry, a mixture of 2 ounces of nitric acid, 3 of muriatic acid (spirits of salt,) and eight ounces of water made hot, should be applied with a sponge, till the whole assumes a crystallized appearance. It must then be immersed in cold water, slightly acidulated, and it will acquire a beautiful and variegated appearance. Different figures are given to the tin by heating it to different temperatures, such as stars, fern leaves, &c.; and when varnished of different colours, a fine effect is given to the accidental figures produced.

H. R. W.

DICTIONARY OF CHEMISTRY.

Elasticity is applied in chemistry to signify the power of gases to expand when pressure is removed, as well as to signify the capability of metals, when formed into bars or rods, of being bent, and still retaining the power to return to their original position whenever the force which bends them is removed. There seems little analogy between the two species of elasticity.

Elatin. An active cathartic principle, detected by Dr. Paris in the medicine called *elaterium*, the produce of the wild cucumber.

Elecampane. The root of the *inula hellenium*, from which is obtained the peculiar vegetable principle called *inulin*.

Electricity. A branch of science closely connected with chemistry, which comprehends a great variety of minute and complicated phenomena. The term is derived from *electron*, the Greek name of amber, the effect of rubbing which was the first electrical phenomenon discovered, but we know no comprehensive definition of the science.

Electrics. Those substances which can be made to exhibit electrical phenomena. When no other mode of exciting electricity but friction was known, this name was confined to few bodies; it now includes a very great number.

Electro-magnetism. The name

given to a class of interesting phenomena, first observed by M. Oersted, in 1819, 1820, and from which it is evident that magnetism may be communicated by electricity, and that the two are intimately connected.

Electrometer, Electroscope. Instruments for measuring electricity, of which there are several.

Electrophorus. The name of an instrument invented by Volta, in which electricity is excited by contact.

Electrum, *argentiferous gold*. An ore of gold.

Elements. A term synonymous with *first principles*, *undecompounded substances*, and *simple substances*. The term, as now used, never means any thing more than substances which the art of the chemist has been unable to analyze.

Elemi. A resin, the produce of the *amyris elemefira*, an American tree.

Eliquation. A species of distillation, which consists in separating by heat two substances, which require different temperatures to fuse them.

Ellagic Acid. An acid which M. Bracconot discovered in an infusion of galls, and of which nothing more is known.

Elutriation. That species of washing used by chemists and metallurgists, in which a stream is made to pass over a substance, and separate the light earthy parts from heavier metallic ones.

Emerald. A well-known and beautiful gem, of which there are several kinds, but all distinguished by a green or blue colour. The most beautiful emeralds come from Peru, and as gems they are valued next the ruby. They consist of silica, alumina, glucina, iron, oxide of chrome, and water.

Emery. A species of *corundum*, much used in the state of powder, to polish hard minerals and metals. It is composed of 80 alumina, 3 silica, 4 iron, 7 parts being lost in the operation. It occurs at Naxos and Smyrna.

Emetin. The peculiar vegetable principle in ipecacuhana, and which is a very strong poison, six grains producing death.

RED THEATRE FIRE.

Those of our readers who have seen the celebrated *Freischütz* performed, have probably, like ourselves, been dazzled and confounded by the red glare which fills the whole theatre; and may therefore like to know how it is made. The following is probably the receipt:—Take 40 parts of dry nitrate of strontia, 13 of powdered sulphur, 5 of chlorate of potassa,* 4 sulphuret of antimony, and add a little powdered charcoal. The chlorate and sulphuret should be separately powdered, and mixed with the other ingredients on paper. The whole mixture is combustible, and when set on fire burns with a deep coloured red flame.

SIR HUMPHRY DAVY's COPPER

The *Samarang*, a twenty-eight gun ship, has arrived at Portsmouth, after having been only a few months on the American station. She was coppered at that port under Sir H.'s direction, and though the copper was preserved by the action of iron, the animalcula, which the oxidation of the copper used to destroy, preyed with such security on the bottom of the *Samarang*, that it was covered with barnacles and seaweeds to a degree which prevented her being steered with the necessary accuracy. She has therefore returned to England to be docked and new coppered.

TO RESTORE OLD PICTURES.

Besides that combination of hydrogen and oxygen which produces

* We hardly need to remind the readers of The Chemist, that the chlorate is explosive, which is the reason for pounding it separately and carefully. It is said that ten parts of nitrate of potassa may be substituted for the chlorate.

water, M. Thenard has effected another, the result of which is a liquid, called oxygenated water, or per-oxide of hydrogen. There is some difficulty in procuring this substance; but when procured it is found to be an admirable means of restoring old pictures, making the *whites*, in particular, perfectly fresh and good looking.

OMNIVOROUS NATURE OF MAN.

As the physical capabilities of his frame enable man to occupy every variety of climate, soil, and situation, it follows of necessity, that he must be omnivorous, that is, capable of deriving sufficient nourishment and support from all kinds of food. The power of living in various situations would be rendered nugatory by restriction to one kind of diet.

If it was the design of nature, that the dreary wastes of Lapland, the naked and barren shores of the Icy Sea, the ice-bound coasts of Greenland and Labrador, and the frightful deserts of Tierra del Fuego, should be not left entirely uninhabited, it is impossible to suppose that either a vegetable or even a mixed diet is necessary to human subsistence. How could roots, fruits, or other vegetable productions be procured, where the bosom of the earth is closed the greater part of the year, and its surface either covered with many feet of snow, or rendered impenetrable by frost of equal depth? Experience shows us that the constant use of animal food alone is as natural and wholesome to the Eskimaux, the Samoiedes, the inhabitants of Tierra del Fuego, &c. &c. as the most careful admixture of vegetable and animal matters is to us. We even find that the Russians, who winter on Nova Zembla, are obliged to imitate the Samoiedes, by drinking fresh rein-deer blood, and eating raw flesh, in order to preserve their health. Dr. Aikin informs us that these practices were found most conducive to health in those high northern latitudes. Hence, we shall be less surprised at finding men, in certain situations, living and enjoying health on what seem to us the most filthy and disgusting objects. The Greenlander and the inhabitant of the Archipelago between north-eastern Asia and north-western America, eat the whale, often without waiting for cookery. The former bury a seal, when they catch one, under the grass in summer, and the snow in winter, and eat the half-frozen, half-putrid flesh with as keen a relish as the European finds in his greatest dainties. They drink the blood of the seal while warm, and eat dried herrings moistened with whale oil.

In the torrid zone, on the contrary, circumstances are very unfavourable to raising and supporting those flocks and herds of domesticated animals, which would be necessary to supply the numerous population with animal food. The number, fierceness, and strength of beasts of prey, the periodical alternations of rains and inundations, with the long continued operations of a vertical sun, whose direct rays dry up all succulent vegetables and all fluids, are the principal and insurmountable obstacles. The deficient supply of flesh is most abundantly compensated by numerous and valuable presents; by the cocoa-nut, the plantain, the banana, the sago-tree; by the potatoe, yam, cassava, and other roots; by maize, rice, and millet; and by an infinite diversity of cooling and refreshing fruits. By these precious gifts, nature has pointed out to the natives of hot climates the most suitable kind of nourishment: here, accordingly, a vegetable diet is found most grateful and salubrious, and animal food much less wholesome.

In the temperate regions of the globe, all kinds of animal food can be easily procured, and nearly all descriptions of grain, roots, fruit, and other vegetable matters; and, when taken in moderation, all afford wholesome nourishment.

Here, therefore, man appears in his omnivorous character. As we pass from these middle climes towards the poles, animal matters are more and more exclusively taken: towards the equator, cooling fruits and other produce of the earth constitute a greater and greater share of human diet.

CONNEXION BETWEEN MORAL DISPOSITION AND FOOD.

That animal food renders man strong and courageous, is fully disproved by the inhabitants of northern Europe and Asia, the Laplanders, Samoiedes, Ostiacs, Tungooses, Burats, and Kamtschadales, as well as by the Eskimaux in the northern, and the natives of Tierra del Fuego in the southern extremity of America; which are the smallest, weakest, and least brave people of the globe, although they live almost entirely on flesh, and that often raw.

Vegetable diet is as little connected with weakness and cowardice as that of animal matters is with physical force and courage. That men can be perfectly nourished, and their bodily and mental capabilities be fully developed in any climates by a diet purely vegetable, admits of abundant proof from experience. In the periods of their greatest simplicity, manliness, and bravery, the Greeks and Romans appear to have lived almost entirely on plain vegetable preparations: in different bread, fruits, and other produce of the earth, are the chief nourishment of the modern Italians, and of the mass of the population in most countries of Europe: of those more immediately known to ourselves, the Irish and Scotch may be mentioned; who are certainly not rendered weaker than their English fellow-subjects by their freer use of vegetable aliment. The Negroes, whose great bodily powers are well known, feed chiefly on vegetable substances; and the same is the case with the South-Sea Islanders, whose agility and strength are so great, that the stoutest and most expert English sailors had no chance with them in wrestling and boxing.

MR. RUTHVEN'S ECCENTRIC WHEEL.

To the Editor of The Chemist.

Sir,—Having ascertained by a correspondence with Mr. Ruthven that his patent for the Eccentric Wheel was taken out in March 1822, and consequently 12 months before the idea occurred to me, I request you will, in justice to him, make this known to the public, and so oblige

Your obedient Servant,
W. K. Shenton.

P.S. My claim to the invention was made from a supposition that (from not having seen an earlier account of it than that in The Chemist) it was a recent discovery.

ANECDOTE OF THE CAMEL.

When the camel will not suckle its young, which is very rare, the Mongols and the Daurian Tungooses have recourse to an expedient detailed by Pallas, in which they employ a plaintive melody imitating the voice of the young animal. This elicits copious tears from the old one, and completely excites its maternal feelings.

TO CORRESPONDENTS.

"A Lover of Unadulterated Food," and "E. Mt," all came too late for our present Number.

We have been obliged to postpone the communication of "Jas. Edwards" for this week.

Erratum.—In The Chemist, No. 42, page 222, *for* the signature R. N. *read* N. R.

*** Communications (post paid) to be addressed to the Editor at the Publishers'.

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The Chemist.

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AVICEPTOLOGY.

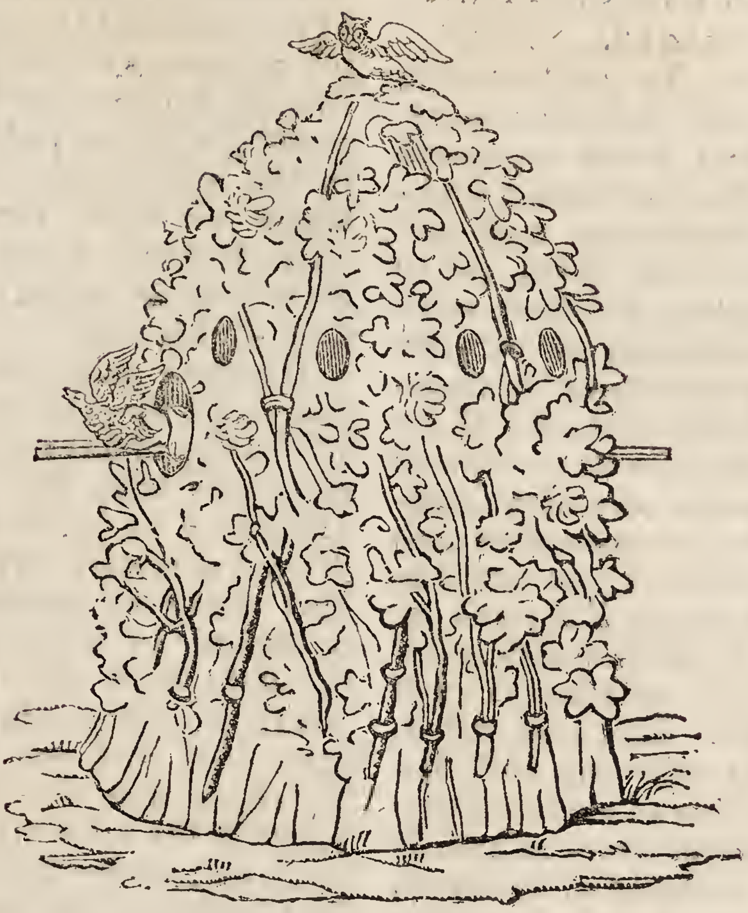
To the Editor of the Chemist.

SIR,—I was looking over a French work a few days ago, when I accidentally blundered on the word which stands at the head of my communication. I was much puzzled what to make of it; my French was completely at fault; it was like nothing I had ever met with in grammars, dictionaries or in the vocabularies of the *Poissardes*; and

I concluded it stood, like Phrenology, or Panumathia, or Lithography, for some new branch of science, or some wonderful discovery, of which, in my retirement, I had never heard. Judge, then, Sir, what was my surprise to find it a new name for a favourite amusement of mine, which has probably been practised wherever mankind have existed. The same spirit which has induced the French to call a *shoe-black*, *un artist decroteur*, or dirt-removing artist; a *cook* a restorer of the body's vigour, and to describe a cook's shop as a dining-room superbly decorated with mirrors and statues, where a dinner of four courses may be had for a shilling, has led them to transform bird catching into *aviceptology*. On turning to my lexicon and dictionary, I found the derivation of the word to be this—*avis*, bird; *capere*, (from which *cepto*,) to catch; *logos*, discourse; whence AVICEPTOLOGY signifies a description of the art of bird catching. So, Sir, I recollect seeing a penny show-man in Paris, who called himself *un opticien*, and described himself as teaching, by his pictorial representations, optics and geography. On the same scale, a *chemical philosopher*, who was changing the colours of some fluids, invited the multitude to come and learn chemistry. A barber's shop, at Paris, is a place where art embellishes nature; and a stall where the newspapers may be read for a *sous*, is a *literary* establishment. To these I may now add, that he who spreads snares for birds is not a fowler but an *aviceptologist*. You must admit, Mr. Editor, that no man can feel humiliated by practising occupations with such illustrious names; and we should do well to follow, in this respect, the example of our neighbours. There would result from it this singular advantage, that the names of trades could no longer be used as terms of reproach. In truth, I am happy to see that we are making some progress in this way, and instead of censuring it, as some great authors do, on the score of the terms not being English, I think this is the very reason why it should be encouraged, as we all know that downright plain English is most impolite language. Not to insist on this, however, the use of the term *aviceptology* in the French book, from which I have made the following extract, is a good reason for my adopting it; and I trust you will also do so, Mr. Editor, if you condescend to insert the short article I herewith send you, and which, ingenious as are our aviceptologists in the fens of Lincoln, the wolds of Yorkshire, and on the cliffs of the Orkney and Shetland islands, may afford them some information:—

"The most amusing mode of catching larks," says the French scientific writer, "is that of putting up mirrors, which are made to revolve on an axis, while around them is placed some of the springes or nets proper to catch the birds. The rays of the sun falling on the moving mirror, are reflected on all the surrounding objects, and so excite the curiosity of the larks, which seem to overlook every thing to gratify it, that neither noise, fire, smoke, nor villanous smells will prevent them from approaching, and sometimes (they dart with so much rapidity,) they appear hurled down from heaven, but on coming near the mirror suddenly stop, and flutter and play and admire themselves.

"The MOVING HUT is a valuable auxiliary to this sport, and may be employed in shooting, and in every other species of aviceptology. It is generally formed of two large hoops placed horizontally, and connected by four slender uprights. It is all covered with branches of trees, fresh cut, so as to resemble a bush as much as possible. The branches are to be long enough, and sufficiently covered with leaves completely to conceal the aviceptologist. In my youth," continues the Frenchman, "I was a great lover of this sort of sport, and had a very convenient hut. It was constructed of strong iron wire, and consisted of two



circular parts, about five feet diameter, and of six uprights, about seven feet long, bent in a circular form in their upper part, and attached each of them to a slender ring, about five inches diameter." (This frame is represented in the Plate, our Correspondent having furnished us with a sketch.)—" It may be readily carried, the uprights making only one rod when taken down and tied together. I did not make the hoops, however, all of once piece: I took six pieces of strong iron wire, each about two feet six inches long, and each made at both ends into a ring, and fixed to one another like a chain, but one of the extreme ends was fashioned into a hook, so that it could easily be attached to the ring at the end of the other piece. These six pieces, when united, formed a hexagonal figure, each side of which was the exact length of the space between the uprights. Each of the uprights had two rings, made of the same sort of wire, at the spots where the hoops were to be placed, and the rings were sufficiently large to allow of the chain hoops to pass through them. I always tied the hoops fast to the uprights. I covered the whole with a piece of light green cloth, which was fastened to the upper little circle, and in the outer part of this there were a number of loops, to which I could fasten small branches of trees, full of leaf, so as entirely to cover the hut. About the height of the aviceptologist's eyes, when seated, there were holes made in the green cloth, so that I could see what was going on all around. There was also a hole through which I could put my arm, to take the birds from the net, to withdraw the net, or whatever else was necessary."—(Our Correspondent has also sent us a drawing of the hut complete, which will be seen above.)

This, Mr. Editor, is the learned aviceptologist's description of his moving hut, in his *Traité de la Chasse*, and if you think it worth insertion in your miscellany, you will greatly oblige one of your constant readers, who is

An old Bird-catcher,
Proud of a new Name.

Ely, Dec. 8, 1824.

LECTURES ON CHEMISTRY AT THE ROYAL INSTITUTION.

NITROGEN.

Lecture 18. In commencing this Lecture, Mr. Brande observed, that it had been supposed there was another compound formed between hydrogen and oxygen, which had been called oxygenated water; but from some circumstances which occurred when Mr. Faraday was making his experiments on the condensation of the gases, there was reason to believe that this supposed chemical compound was only a mixture of oxygen with water. He then proceeded to describe the compound formed by the union of hydrogen with chlorine, which is the substance called *muriatic acid gas*. It is also called, and more in conformity with the general principles of chemical nomenclature, *hydrochloric acid gas*. If we mix equal volumes of hydrogen and chlorine over water, no action takes place between them, unless they are exposed to the light; and if placed in the solar beam, they then unite rapidly, and the result is a gas precisely equal in volume to both the hydrogen and chlorine employed. This is muriatic acid gas, and it is therefore a compound of one volume hydrogen, and one volume chlorine, forming one volume of muriatic acid gas, equal in bulk to the two volumes. These two gases may also be made to unite by the electric spark. The Professor then admitted into the exploder, described at p. 233, equal volumes of hydrogen and chlorine, and on applying an electric spark they united with a flash of light. On allowing water to enter the exploder, the whole of the resulting gas was absorbed, and a vegetable fluid with which the experiment was made was instantly changed to red. This property of muriatic acid gas, to combine instantly with water, makes it necessary that all experiments with it should be made over mercury. This was further illustrated by immersing a small jar containing muriatic acid gas over mercury, and introducing into it a few drops of water, when the whole of the gas was instantly absorbed. One particular property of muriatic acid gas, that of smoking whenever exposed to the atmosphere, arises from its uniting so readily with the vapour contained in the atmosphere. Whenever a bottle or flask containing it is opened, dense white fumes immediately arise, which are characteristic of this acid.

Muriatic acid gas may be decomposed by placing in it a quantity of the metal potassium, which combines with the chlorine, very often with flame, and sets the hydrogen at liberty. This experiment was made by placing a piece of potassium in a retort containing muriatic acid gas, and applying heat; the potassium took fire, and combined with the chlorine; the hydrogen was also liberated, and burnt in the atmosphere. Both by analysis and synthesis we find then that hydrogen and chlorine unite in equal volumes to form muriatic acid gas. It may therefore be thus represented:—

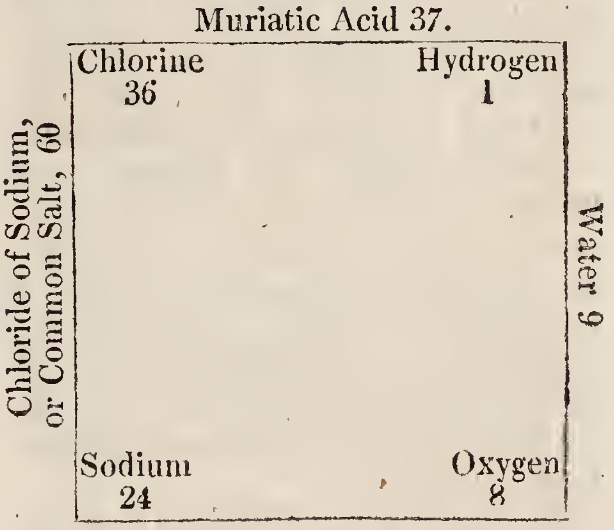
Hy.	Ch.	=	Mur. Acid.
1	36		37

The equivalent number therefore for muriatic acid gas is 37. In knowing the composition of water and its equivalents, and of muriatic acid and its equivalents, the chemical student is in possession of some most important data on which numerous chemical calculations are founded.

Muriatic acid exists in its pure state as a gas, and it is colourless like air: its specific gravity is to hydrogen as 18.5 to 1, to air as 1.298 to 1.000, and 100 cubic inches weigh 39.18 grains. It may be easily procured by pouring sulphuric acid on sal ammoniac, which is decomposed by this acid at ordinary temperatures. The sulphuric acid combines with the ammonia, and the muriatic acid is liberated and collected over mercury. In making this and similar experiments, it is usual to stuff a little piece of blotting-paper in the mouth of the re-

tort, in the first instance, which serves to carry off the vapour of the air contained in the retort. This gas cannot be breathed, and will not support combustion. A taper is instantly extinguished by it. Water instantly absorbs it, and takes up 480 times its own volume. The specific gravity of water saturated with muriatic acid is 1.21, its specific gravity being therefore increased rather more than one-fifth. This gives us a means of determining, by the specific gravity of common muriatic acid, the quantity of real acid it contains. For this purpose tables have been constructed, showing the quantity of real acid contained at every weight between 1.21 and 1.1. When muriatic acid is thus combined with water, it is the common liquid muriatic acid, and should perhaps be distinguished from the acid itself in a liquid state, Mr. Faraday having succeeded in liquefying the perfectly dry gas. It is done, however, under a pressure equal to 45 atmospheres, and therefore the specimen I hold in my hand, said Mr. Brande, in this glass tube, is rather dangerous to handle. By placing it however in a cooling mixture it may be kept without risk. What the Professor showed was a quantity of yellowish fluid inclosed in a glass tube, properly sealed at the blow-pipe; and certainly, as a small increase of temperature might make it assume the gaseous form, it was not a pleasant plaything.

The common method of procuring muriatic acid is to distil it over from common salt with which sulphuric acid is mixed, receiving it and condensing it in water. In pharmacy the process is the same, except, as we understood, that the water is distilled over with the acid. The proportions are, common salt 32 parts, sulphuric acid 22 parts, diluted with one part its weight of water. In the common methods an iron retort is used, and the vessels for receiving the acid are of earthen ware. The explanation now given of the change which takes place by mixing sulphuric acid with common salt, differs from the former mode of explaining this fact. Common salt is now considered as a compound of chlorine and sodium; and it may therefore be asked, whence comes the hydrogen necessary for the production of muriatic acid? From the water. The sulphuric acid is introduced mixed with water; the oxygen of which goes to the sodium, forming soda, which combines with the sulphuric acid, and produces sulphate of soda, while the hydrogen of the water combines with the chlorine, and passes over as muriatic acid. The following diagram may explain this mutual decomposition:—



32 Soda.
40 Dry Sulphuric Acid.

72 Dry Sulphate of Soda.

49 Liquid Sulphuric Acid.

The muriatic acid prepared according to the London Pharmacopœia in these proportions is of the specific gravity 1.160, or it contains 31 per cent of pure acid. Muriatic acid, when fresh made, is colourless, but it acquires a slight yellow colour from keeping; and in general it is of a deep yellow, owing to its containing iron. Sometimes also it contains sulphuric acid and other substances, which may be separated by re-distilling it off a small quantity of common salt, when the acid rises pure, and may be condensed in water. When the solution of muriatic acid is boiled, the whole of the muriatic acid escapes as gas.

Hydrogen and iodine combine, and form hydriodic acid. It may be prepared by exposing a piece of phosphorus to the action of moist

iodine, and must be received over mercury. It soon acts also on the mercury, forming a yellow coloured substance, and must therefore be removed as soon as possible into another vessel. Hydriodic acid is a colourless gas, 100 cubic inches weigh 133.6 grains, its specific gravity is to hydrogen as 63 to 1, to air as 43 to 10. It is a compound of one volume hydrogen and one volume vapour of iodine, and is thus represented:—

Hyd. 1	Iod. 125	126.

It is decomposed by chlorine, which combines with the hydrogen and forms muriatic acid. If more chlorine is added than combines with the hydrogen, the remainder combines with the iodine, and forms chloroiodic acid, otherwise the hydrogen remains pure. Mr. Brande then said he had concluded all which he meant to say on the combinations of hydrogen with oxygen, chlorine and iodine, and he should proceed to another elementary substance.

Nitrogen is so called on account of its existing in abundance, and being obtained from nitre. This term implies nothing concerning its nature, and will be equally applicable, should it be discovered that nitrogen is a compound substance, as at present, when it is believed to be an element. Nitrogen has also been called azot, a name derived from its property of being fatal to animal life, but which property it shares with all other gases, not even excepting oxygen, though its action is not so immediate. The term azot might therefore be applied to all gases, and is singularly misapplied to nitrogen, because it is essential to life. It forms a portion of the atmosphere, and there is no other substance which supports life for any length of time but it. Moreover, it constitutes an essential ingredient in the structure and constitution of animals, and ought not therefore to be called by a name which signifies destructive of animals. It has also been called mephitic air, and by some other terms, but none seem more proper than nitrogen.

It was discovered by Dr. Rutherford, in 1772, in examining the residuum of the air after combustion, which he found not to be carbonic acid, and to it he gave the name mephitic air. It is in general obtained from the atmosphere, and by separating from it the oxygen. On moistening the inside of a glass jar, containing iron filings, and confining the air, it is decomposed, the oxygen is absorbed, and the nitrogen left. It is not then pure. Scheele obtained it from liver of sulphur. Phosphorus burnt in common air is also employed to obtain it; and after the whole of the oxygen is consumed, on washing the remaining gas, it will be found to be nitrogen in a state of purity.

One hundred cubic inches of nitrogen weigh 29.65 grains, and its specific gravity, as compared to hydrogen, is as 14 to 1, to common air as 98 to 100, being somewhat lighter than air. It can only be described by negative properties. It is colourless, tasteless, inodorous, insoluble in water, does not support combustion, and cannot be breathed. It is a gaseous body which seems incapable under every circumstance of supporting combustion. It is by some persons considered as a compound, but of this we have no proof; and however plausible and numerous may be the reasons which are urged for this view of the matter, it is only an hypothesis; and as such, till the compound nature of nitrogen is proved, it is better to consider it.

The compounds of this substance are important. With oxygen it combines in four, if not in five proportions; forming two acids and two oxides. The fifth compound has been called hyponitrous acid. The first of these compounds to be treated of is nitrous oxide, or that combination of these two bodies which contains the least proportion of oxygen. To obtain it, we may follow the plan recommended by Sir H. Davy, of heating

nitrate of ammonia in a glass retort to a temperature of about 420, when nitrous oxide passes off, and may be collected over ammonia. If the heat be applied too suddenly or too violently, accidents may happen; but with an Argand lamp, the heat of which we can regulate at pleasure, there is no danger. The specific gravity of nitrous oxide is to air as 15 to 10, to hydrogen as 22 to 1, and 100 cubic inches weigh 46.6. A taper burns in it, having its flame augmented, and being of a purplish appearance. Priestley, who discovered nitrous oxide, called it dephlogisticated nitrous air. Both sulphur and phosphorus, if heated to a certain temperature, burn in this gas with great splendour; but if not sufficiently heated they go out, which shows, it is only at a certain temperature that the decomposition of nitrous oxide, and the union of its oxygen with the phosphorus or sulphur, takes place. It only yields its oxygen at high temperatures.

COPERNICUS.

THE proper name of this illustrious astronomer, that by which he is known amongst his countrymen, is *Koppernick*, and we hardly know by what right it is that we have altered it. Most probably, however, we received the name from the French, or it came to us latinized by the author himself, and he is therefore known here by the name of Copernicus. He is known, too, in general, in our country, only as an astronomer; but though his chief claim to *our* gratitude, and his title to universal reputation rest on his astronomical system, his countrymen remember him as the author of works more immediately useful. He was a physician and a civil engineer,—the Rennie or the Telford of his age and nation, and the aqueducts which he constructed at Graudentz, at Thorn, and at Dantzig, still exist. He was born in 1473; his system was formed about the year 1510, and promulgated to the world about 1540. It was not till long after his death, not till the clergy of the Romish communion began to fear for the revenues of the church, that his system was condemned by its Infallible Head. It was not even till 1821, one century and a half after the truth of this system was demonstrated by the most irrefragable evidence, that the anathema against it was removed at Rome, and that it ceased to be *heresy* in all those who profess the Catholic faith to believe that the world revolved on its axis. Yet this most fallible of all churches seems still as arrogant as ever; and its clergy claim the same right in 1825 to dictate a creed, and require the implicit obedience of their flocks, as they did in 1634.

LECTURES ON CHEMISTRY AT THE MECHANICS' INSTITUTION.

To the Editor of the Chemist.

SIR,—In the report of Mr. Brande's Lecture, contained in your last Number, you remarked that the Professor succeeded with perfect ease in his attempt at the combustion of iron in oxygen gas, while a few evenings since the same experiment failed in the hands of Mr. Cooper. This you very correctly attribute to the difference of accommodations, with respect to the laboratory and assistants, possessed by the two lecturers; and suggest that if the Committee of the Mechanics' Institution intend making chemistry a permanent branch of instruction, it would be advisable in their new building, to construct a laboratory, and provide a regular and skilful chemical assistant.

Having constantly attended Mr. Cooper's lectures from their commencement, I cannot but express my concurrence in the preceding observations; and indeed it is my opinion, that if the execution of Mr. Brande's delicate electrical experiments had been attempted at the Mechanics' Institute, they would generally have failed. Under these considerations, it gives me great pleasure to understand that

a laboratory is one of the principal objects contemplated by the Committee; and I hope that, being of such vast importance to the prosperity of the Institution, it will not be neglected.

With respect to the experiment immediately under discussion, I think it right to state, that although it failed when attempted at the time you mention, yet in the last lecture, while burning sulphur in oxygen, it accidentally succeeded. The iron spoon containing the sulphur was separated from the handle, which continued to burn with a red flame until the whole of the oxygen had entered into combination. His former want of success was at the same time alluded to by Mr. Cooper. After the lecture had concluded, the Secretary read a paper, stating that on a certain day, the Committee would be ready to receive proposals from persons properly qualified for the office of manager of the apparatus, and assistant to the lecturers. The object, therefore, which you contemplated, is likely to be secured, and I trust that a false notion of economy will not lead the Committee to make choice of a person of inferior abilities, while, at a trifling additional expense, the services of an assistant properly qualified might be secured.

In justice to Mr. Cooper's assistants, one of whom, it appears, is his nephew and pupil, I think this should appear in an early Number. The accommodations have been frequently, and not unjustly, complained of, by all who have had to do with them; and I think the present lecturer has succeeded "as well as could be expected." All we can do is to hope that in the new theatre the present inconveniences will be remedied.

I remain, Sir,
Yours, respectfully,
Dec. 22. JAS. EDWARDS.

MOTION OF THE ELECTRIC FLUID.

It has been stated long ago, that an electrical discharge had been transmitted through a wire four miles long, instantaneously and without any diminution of intensity. Mr. Barlow, however, by employing wires of various lengths, up to 840 feet, and measuring the energy of the electric action by the deflection produced in a magnetic compass, finds that the intensity diminishes very rapidly, and is in fact very nearly as the square of the distance inversely. Hence the idea of making electrical telegraphs is quite chimerical. He found, moreover, that though the effect was greater with a wire of a certain size than with one smaller, yet that nothing was gained by increasing the diameter of the wire beyond a given limit.

QUANTITY OF RAIN.

In a very early period of our labours, we noticed the singular circumstance of the quantity of rain which had fallen for the three last years being much beyond the average quantity. We then observed that 1824 promised to be as bad as its watery predecessors (see Chemist, No. 5.) It now appears, that the rain which has fallen in Manchester within these last four months is more than equal to the average quantity of rain which falls in a whole year at London. From tables kept by Mr. John Dalton, at Manchester, we learn the following facts:—

In Sept. rain fell to	5.440 inches.
October........	6.896
November......	5.510
Dec. to 26th....	6.820
	24.666

Since Dec. 26, it appears that 1.015 inches have fallen, making a total of 25.682 inches; the average quantity of rain which falls in Manchester being 34 inches, and in London 22. We hardly indeed require accurate observation by instruments to convince us that the quantity of rain of late has been excessive; but when we find casual remarks thus confirmed, and the quantity of rain increasing year after year, the important fact is too

firmly established not to require philosophical investigation. We have no doubt that attentive observation will ultimately discover the causes of the variations of the seasons, though they are so numerous as at present to defy our classification, and so subtle as to escape our notice. We have no doubt, too, when they are discovered, that which now appears to be anomalous will then be fully explained; and some preservative meteorological laws will be discovered, which will be as to the weather what the precession of the Equinox, and the astronomical law discovered by La Place, is in astronomy,—the evident means of continually preserving unchanged the order of the world.

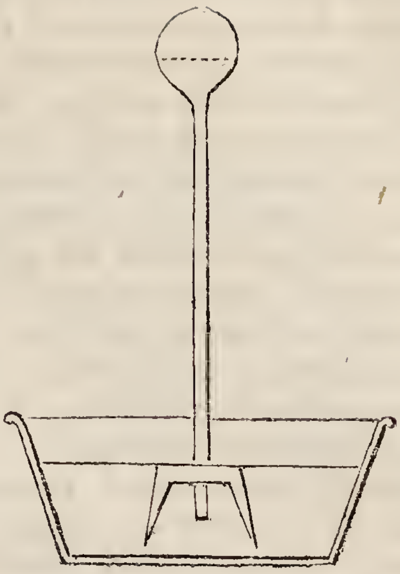
QUERIES.

The best method of making a permanent (black) writing ink.

Likewise a receipt for blacking—one that will produce a good black and polish, and not injure the leather.

TIN SET ON FIRE BY COPPER, WATER, AND AN ACID.

On a piece of tin-foil, of twice or three times the size of this leaf of paper, previously spread out smoothly, place a tea-spoonful, or quarter of an ounce, of nitrate of copper; moisten the nitrate by sprinkling over it so much water, and no more, as will just make it into a liquid paste, and then cover it with a few filaments of tow (this, however, is not absolutely necessary.) Then fold up the foil as quickly as possible round the moistened nitrate of copper, and press down the edges and corners of the parcel to exclude the air. In a few minutes it becomes heated, a portion of the dissolved nitrate begins to ooze through, and a copious stream of nitrous gas forces its way out at different openings, attended with sparks of ignited tin and small jets of fire. The success of the experiment is much assisted by sprinkling the mass with a little water, if the action be feeble at the moment the gas appears to rush out.



MATTER HAS NO PERMANENT FORM.

The numerous examples already given in our pages of changes of form and of state in different bodies by the application of heat, which itself has no form, and which is so untangible and inappreciable, that it is doubted whether it is a substance or an *energy*, must satisfy the reader that all matter has no permanent and unchangeable form. Another little instance of this great philosophical truth may be found in the following pleasing experiment:—Take a glass globe with a long slender neck, such as is seen in the figure; pour into it three or four tea-spoonfuls of sulphuric ether, and fill up the vessel with cold water. Take a basin of water in which is placed a piece of lead, perforated, as seen in the plate, or employ any other means of keeping the glass upright, and then closing the mouth of the glass globe with the finger, invert it in the basin over the water. The ether then rises to the upper part of the globe, and if hot water be gently poured over it, the ether is gradually converted into an invisible gaseous substance, which, by its expansive power, expels the water from the globe, and occupies its place. If cold water be afterwards poured on the globe, the ether is condensed, and the water rises up, and fills it as at first. This experiment may be repeated any number of times, taking care that the whole of the water is never expelled.

LIFE OF BERTHOLLET.

Claude-Louis Berthollet contributed probably more than any other chemist of his age, to improve the chemical arts. Though rendered illustrious by numerous discoveries, his highest fame consists in the application of science to practical improvements. The following account of his life, abridged from a cotemporary publication, will not, we hope, be unacceptable to our readers.

Berthollet was not a native of France. That country claims him, along with Cassini, and Winslow, and La Grange, only as the son of her adoption, and whom it was her glory to foster and to cherish. He was born at the family mansion in Talloire, near Annecy, in Savoy, on the 9th of Dec. 1748. From this spot, he made his first progress into the world, to commence his studies at Chambéry, in prosecution of which he next proceeded to the Collège des Provinces at Turin, a celebrated establishment instituted by Charles Emmanuel III. King of Piedmont, where many of the distinguished men of talent which that country has produced, have been imbued with their first thirst for science.

Here the young Berthollet attached himself to the study of medicine, less, it may be supposed, from any views of interest to be gratified in its pursuit, than from that inclination already powerful, which soon became the master passion of his breast, for the investigation of those sciences which form the basis of the school of Hippocrates. He remained no longer at Turin than just to take the degrees in his profession, after which he proceeded to Paris, as the future theatre of his speculations and pursuits.

His first appearance in that capital was a singular one, and the first acquaintance he made is a remarkable proof of the open frankness of an honest and independent heart. In that immense city, Berthollet had not one friend; he had not even a single introduction to any one. But, at the time, it happened that one of the most distinguished of the medical profession was Tronchin, a native of Geneva; and the young Savoyard conceived that in Paris he might be claimed as more than half a countryman. On this slender ground of introduction he waited upon Tronchin, and, quite contrary to what the manners of the times might have led us to expect, his new-made acquaintance, prepossessed at first by his frankness and intelligence, grew gradually more and more attached to him, until intimacy ripened into firm friendship. Nor did this friend content himself with mere professions of regard, but soon, by means of his all-powerful influence with the Duke of Orleans, Louis, grandfather of the present Duke, and uncle of the then reigning king, he procured for his protegé the situation of one of the physicians in ordinary to that prince. In this situation, the independent character of the man, and his attachment to science, appeared. For while others found their way to rank and riches by their assiduity at court, Berthollet at once and entirely abandoned himself to the prosecution of those studies, which continued to occupy and engross his whole after life.

The first essays of M. Berthollet, and his first appearance as a philosopher, are so intimately connected with the revolution which the science of chemistry was then undergoing, that it is impossible to understand the one, or to appreciate the other, without a short view of the leading principles of the old and new systems.

The radical evil of the ancient system of chemistry, the baneful influence of which pervaded every part of it, was Stahl's doctrine of *phlogiston*. When a metal is calcined under contact with the air, it is gradually converted into an incoherent earthy mass, formerly styled a *calx*. This calx, according to the old school, is itself a simple substance; and the metal is a compound of the *calx* and *phlogiston*. When a metal, therefore, is calcined, it, in their language, is re-

solved into the calx, its basis, and at the same time it loses some other thing unknown,—the ideal principle named phlogiston. To this hypothesis, the processes of experimenting, as they improved, furnished an insuperable objection. When a metal is converted into a calx, or gets rid of part of its composition, viz. phlogiston, it *increases considerably in weight;* and, on the contrary, when a calx is brought back to the metallic state, when it gains its phlogistic constituent, it *loses precisely the amount of weight which it had previously gained.* That is to say, the simple basis, the calx, is heavier than when to this same basis there is superadded phlogiston. To any unprepossessed mind, this objection is fatal to the hypothesis of Stahl; but men, bred up in any scientific creed, are not so easily induced to renounce their first belief. And, accordingly, the disciples of Phlogiston only declared that this substance is *specifically light*, or has a principle of levity; or to speak more clearly, that it paralyses the action of gravity.

But whilst every other chemist in Europe, with an obsequiousness unfortunately more to be lamented than wondered at, was perplexing his judgment, and even distorting fact itself, in order to adapt the phlogistic theory to the progress of science, Lavoisier felt it every day more and more impossible to admit its accuracy. The important discoveries of Black, Priestley, Scheele, Cavendish, and others, respecting factitious airs, and the phenomena attendant on the calcination of metals, at an early period seemed to him, not corrective but subversive of the system of Stahl. He reasoned nearly as follows:—

A metal calcined invariably *gains a considerable increase of weight.* In any given close vessel, only a *determinate portion of metal* can be calcined. Heat may be applied to the vessel in every various degree, and for any length of time: the quantity of metal which may be calcined within it has nevertheless its fixed limits, and calcination in such a vessel, once brought to a period, *can never again be renewed.* But if the vessel be now opened for a short time, and a fresh supply of atmospheric air admitted, the process of calcination may be renewed, and again carried on, *but within the same limits as before.* In *the open air*, metals may be calcined *to any extent.* After calcination in a close vessel, the body of air originally included has *lost considerably in volume and weight, and has changed several of its properties. The increase of weight gained by the metal measures the exact loss of weight sustained by the air,* so that the weight of the whole remains unaltered. From these premises, Lavoisier concluded, that since the presence of atmospheric air is *essential* to calcination, since a given quantity of air serves to calcine only a given quantity of metal, and since this process invariably transfers a given weight from the air to the metal, calcination must consist in the absorption of a ponderable principle from the air.

When mercury is calcined in a close vessel, it is gradually converted into a red coloured calx: at the same time, a portion of the confined air disappears, and the residue is incapable of contributing to new calcination, or of maintaining either combustion or respiration. If the red calx be now exposed to a stronger heat, in contact with this deteriorated air, the metal and the air simultaneously assume their original appearance, and recover their original properties. The phenomena of this experiment at once furnished Lavoisier with the analytical and synthetical tests of his theory, and enabled him to prove that atmospheric air is no element, but a compound substance, of which one constituent can support combustion and respiration, while the other cannot.

It was unfortunately laid down by Lavoisier, as one of his fundamental principles, that oxygen constitutes the sole principle of acidification. In a memoir on Sul-

phuretted Hydrogen Gas, in 1778, Berthollet shows that sulphuretted hydrogen gas, in which oxygen is not present, nevertheless *performs all the functions of an acid:* and surely it seems reasonable that a doctrine opposed *in toto* by every one, should not first be received as generally correct by him who alone had discovered any just grounds for qualifying one of its leading principles. Yet it is strange enough that this very man proved eventually the first leading chemist who did admit the just doctrines of the new theory, and it seems stranger still that those who held out longest against *its truths*, were also the first to embrace and defend *its errors.* But so it was; for Berthollet's subsequent assertion, arguments, and numerous decisive experiments, all proving oxygen not to constitute the sole principle of acidification, fell for many a year unheeded on the ears and understandings of men of science, until the united force of the facts brought forward by Gay-Lussac, Thenard, and Ampère, joined to the profound and admirable reasoning of Sir H. Davy, at length established the accuracy of this limitation and qualification of the principles laid down by Lavoisier.

In another memoir of onr chemist, on the Nature of the Volatile Alkali, presented soon after to the Academy, he announced a theory of his own upon the subject, which proceeded upon a basis altogether erroneous. This essay was entrusted to Lavoisier, to report upon its merits to the Academy, who, with disinterested tenderness for the honour of his antagonist, dissuaded him from committing himself by the publication of his system; and Berthollet's conduct is not less to be admired for the assent which he immediately yielded to the kindness and to the experience of his adviser. The memoir was not published. His reputation was thus not publicly staked in support of any erroneous system; and the stimulus which this very restraint gave to the ardour of his researches, led him a few years afterwards to one of his most elegant discoveries, that of the true nature of the volatile alkali. It is impossible not to esteem so much generous co-operation on the part of these two illustrious chemists, eager only for the advancement of science, and opposed as they then were in many of their views; yet the younger remaining as free from distrust of his antagonist's advice, as the elder was untainted by jealousy of his rival's reputation.

(*To be continued.*)

ADULTERATION OF FOOD.

REMARKS ON ACCUM.

(*Concluded from p.* 221.)

We now come to a class of persons who, from the first introduction of their manufacture, have enjoyed their full share of abuse, and are considered under a kind of hereditary imputation of murders innumerable—the Brewers. P. 135: —" Malt liquors, and *particularly porter*, the favourite beverage of the inhabitants of London and of other large towns, is amongst those articles in the *manufacture* of which the greatest frauds are frequently committed." P. 190:—" But the reader will likewise notice that there are *no convictions in any instance* against either of the eleven great London porter brewers for any illegal practice." And (p. 191) the " eleven great brewers of this metropolis are persons of such high respectability, that there is no ground for the slightest suspicion that they would attempt any illegal practices which they were aware could not possibly escape detection in their extensive establishments." The " eleven great houses" will not, I think, feel much flattered by the compliment to their " high respectability," qualified as it is by the more efficacious reason, " the impossibility of escaping detection." Agreeing with the author, that from the quantity necessary in the large establishments, detection would be inevitable, subject as they are to the precarious visits of the Excise Officer, and exposed as they must be to the observation of their numerous ser-

vants, I am at a loss to know how he can reconcile this opinion with his previous assertion, that in the manufacture of "porter particularly," the greatest frauds are frequently committed. The only proof which is offered is a quotation from a work called "Child on Brewing," and I leave the reader to judge from the extract what reliance should be placed on such an authority: "After having stated the various ingredients for brewing porter, the author observes, that, however much they may surprise, however pernicious or disagreeable they may appear, *he* has always found them requisite in the brewing of porter, and *he thinks* they must invariably be used by those who wish to continue the taste, flavour, and appearance of the beer; and the author can affirm from experience, *he* could never produce the present flavoured porter without them." Mr. Accum, however, says, (p. 147,) "The only essential difference in the method of brewing porter and other kinds of beer was, that porter was brewed from brown malt only, and this gave to it both the colour and flavour required." It was subsequently ascertained that a greater quantity of wort, of a given strength, could be procured from pale than from brown malt, in consequence of which an artificial colouring matter, prepared from brown sugar, was allowed by law, which was afterwards forbidden, and an article called "patent malt" substituted; but even this, Mr. Accum is "assured, (p. 151,) by some brewers of eminence, is unnecessary, and that porter of the requisite colour may be brewed better without it." One extract more will suffice—(p. 181): "The present entire beer therefore is a very heterogeneous mixture, composed of all the waste and spoiled beer of the publicans — the bottoms of butts—the leavings of the pots—the drippings of the machines for drawing the beer—the remnants of beer that lay in the leaden pipes of the brewery—with a portion of brown stout—bottling beer and mild beer." It is impossible to misunderstand the meaning that is intended to be conveyed by this insinuation, and yet in the very next page, he says, "The old, or entire beer, we have examined as obtained from Messrs. Barclay's and other eminent London brewers, *is unquestionably a good compound.*" Such inconsistent and contradictory statements require no comment; the only question is, are we to give credit to Mr. Accum. It is evident, from the convictions on record, that the ale brewers were formerly in the habit of using other articles than malt and hops in the manufacture of their beer; they were, however, *chiefly* of a harmless nature; and I have good reason to believe, that the improved knowledge in the art of brewing has now nearly abolished the practice. The few instances of convictions of late years is a strong confirmation of the fact. Your friend,

OBSERVATOR.

To the Editor of The Chemist.

Dec. 27, 1824.

MR. EDITOR,—I am a constant subscriber to your work, and now beg to address you on the subject of the animadversions on Mr. Accum's work, "On Adulteration of Food," which have appeared in several of your Numbers.—I am induced, on some of the common principles of justice, to remark, that no man should be judged without the accused and the accuser being present, and the accuser should never sit in judgment on his own case. Your correspondent seems to me to have violated these two equitable principles. Mr. Accum, not being, however, in the opinion of many, so criminal as your correspondent seems to infer, having long since left this country, he is but striking a *fallen enemy*, and the *Baker* is not the most disinterested judge in his own case. I would ask you, Mr. Editor, or any of your chemical friends, from what cause does the difference between bread manufactured in our farm houses and in our metropolis so widely differ? If we pass on to the

article of beer, is not Mr. Accum's work a faithful enumeration of *facts* in the cases of the prosecution and conviction of the Board of Excise. Your correspondent is surely aware these convictions stand also on other record than that of Mr. Accum. Before Mr. A. can be reprehended for his book, it is surely necessary to prove that his statements are false. The adulterations of many common articles of food are notorious to the generality of purchasers, and however desirable the absence of suspicion, it is not wise to confide where confidence is abused.

A Lover of Unadulterated Food.

[We as readily insert the defence of Mr. Accum as the attack—not on him, but on his book. The great fault of that work is, that Mr. Accum infers, because some men have been found guilty of frauds, that all tradesmen are rogues. Without pointing out to us the signs by which the frauds may be detected, and the honest discriminated from the dishonest, he narrates *instances* of individual frauds to support his inference, that frauds are always committed. Our Correspondent, "Observator," has shown that Mr. Accum, in his zeal to stir up suspicion, to which men are sufficiently prone, has fallen into contradictions; and this was with us a reason to insert his communication. We do not agree with our second Correspondent, that this is an attack on the absent. Mr. Accum's work is still the text-book for much vituperation.]

COMBUSTION.

To the Editor of The Chemist.

I, for one, Mr. Editor, am happy to learn that there is still so much common and good sense left in this degenerate world as your correspondent R. N. or N. R. seems to claim for himself, though he has directed them to exposing so low a subject as me, Simon Pry, to ridicule. I am too proud of having the same name and form as a person so nobly endowed ever to repine at being the whetstone of his wit, and the foil to his exceeding brilliancy; and I shall be delighted by putting one or two more queries, to call your correspondent's great parts again into excition.

Having, according to his advice, called "into exercise all" my modicum "of that valuable kind of sense" he is so amply endowed with, I must say I find it difficult to understand the last passage of his letter. Condescend, therefore, Mr. N. R. to enlighten me as to what you mean by "*combustion*"—(i. e. the light and heat evolved by chemical action)—"*having to search for food* among a heap of rubbish." I comprehend the idea of a combustible immersed in pure oxygen, or in the atmosphere (alias the rubbish of N. R.,) but I cannot, being somewhat slow of mind, understand this of "*combustion.*" Perhaps your correspondent, Mr. Editor, is here using a trope or figure; and having more of poetry than *pryingness* in him, has let go the sense for the sake of the sound and the pretty piece of poetry at the end. Do, Mr. Editor, beg of him to explain his concluding passage; which, being a climax to the whole, and meant to set the crown of glory on his illustrious epistle, must, to those who understand it, be of inestimable value. I now require a little information as to the comparison he taunts my ignorance with of nitrous oxide; and should certainly think of making the inquiry he mentions, if I thought it could be answered; especially as *pure oxygen*, when breathed, has no such effect as is produced by the nitrous oxide. I have heard that nitrous oxide, when breathed, produces certain effects different from the atmosphere; and as the same effects are not produced by oxygen itself, and cannot therefore be produced by this substance being liberated from the nitrous oxide, I beg leave still to ask him, who seems to know all about these matters, *why* this is?

Being no more instructed by the analogous case referred to by N. R. than by his metaphor, I should have been no wiser than before had not I read The Chemist with attention, and learnt from it that my notion of *combustion*, which led to the query, was an error. From what I have since read in the reports of the Lectures, and in the article of

the Dictionary of Chemistry, "*Combustion*," I understand the light and heat not to depend on the quantity of the *combustible* or on the *quantity of oxygen*, but on intense chemical action; and oxygen has been mistakenly called a supporter of combustion, because it is one of those substances which, by its intense chemical action with many other substances, causes much light and heat to be evolved. Under the old theory, the question I put could not, I believe, be answered,—at least it is not done by N. R. Under this new theory it seems to me it may be answered, and the answer will be found to strengthen the theory. This theory says, the light and heat are the consequences of intense chemical action; and may be, and are evolved by all substances, whether oxygen be present or not, which act energetically on each other. It may be expected, therefore, that two bodies, neither of which is in combination, having none of their attractive power diminished, will unite more rapidly, than when one of them, as in the union of oxygen and nitrogen in the atmosphere, has lost part of this power. The reason, then, on this theory, why more light and heat are evolved by substances in pure oxygen than when they unite with the oxygen of the atmosphere, seems to be that its chemical energies in the latter case are weakened by being already combined with nitrogen. This combination must be overcome by the affinity of the combustible before a union takes place between it and the oxygen of the atmosphere, and is already overcome when pure oxygen gas is employed.

I venture to hazard this further explanation, Sir, because it will, I hope, again call up your correspondent N. R. to teach us what is right on this subject, and enlighten me and the rest of your readers with apt quotations, illustrative analogies, and profound metaphors.

I am, Sir,

Your most obedient Servant,

SIMON PRY.

London, Dec. 30, 1824.

DICTIONARY OF CHEMISTRY.

EMPYREAL AIR. The name given by Scheele to *oxygen gas*.

EMPYREUMA. The name given to the peculiar flavour or smell which vegetable or animal matters acquire from destructive distillation having begun when not intended. It is also called a burnt taste or smell.

EMULSIONS. Imperfect combinations of oil and water; or rather the oil is diffused through the water by the aid of mucilage.

ENAMEL. A transparent and fusible substance, of which there are a great many, which is spread over earthenware and a variety of other things. It may be rendered opaque by the white oxide of tin, or putty. The *enamel* of the teeth is a compound of phosphate of lime, carbonate of lime, and gelatine.

ENTROCHI. A peculiar species of *fossil*, which seems to be the petrefied arms of the sea star-fish, *stella arborescens*.

ENS VENERIS, *flores martials*. The *ferum ammoniatum* of the Pharmacopœia; a muriate of lime with a small but variable quantity of permuriate of iron.

EPIDERMIS. The outer or scarf skin. It resembles coagulated albumen.

EPIDOTE, *pistacite*. A mineral found in Norway and in various parts of Scotland. It consists of silica 37, alumina 21, lime 15, oxide of iron 24, oxide of manganese 1.5, water 1.5.

EPSOM SALTS, *sulphate of magnesia*.

EQUIVALENTS. We are indebted to Dr. Wollaston for this term, and it signifies the respective quantities of substances which combine in the smallest or first proportion, or which are necessary to neutralize some other substance, which is chosen as the standard. The specific gravity of the quantities of the different substances thus combining, compared with that of the standard, is their equivalent numbers. Some philosophers choose oxygen as the standard, from "its universal relations to chemical matter;" others choose *hydrogen*,

because it is the lightest body known, and thus fractions are not so much required; and as the combination of *hydrogen* with oxygen in the proportion to form water gives at once a definite number for oxygen with reference to hydrogen, the lighter body seems better adapted for a standard.

ESSENCES, *volatile essential oils.* The peculiar principles of some substances are called essences.

ETHER. A volatile fluid, produced by the distillation of alcohol with an acid, generally either the sulphuric or nitric, and hence called sulphuric or nitric ether. It is a compound of hydrogen, carbon, and oxygen.

ETHIOPS, MARTIAL, *black oxide of iron.*

ETHIOPS, MINERAL, *black sulphuret of mercury.*

ETHIOPS PER SE, *black oxide of mercury.*

EUCHLORINE, *protoxide of chlorine.*

EUCLASE, *prismatic emerald.*

EUDIOMETER. An instrument for ascertaining the proportion of oxygen gas in any quantity of air. There are a great number of instruments of this description, invented by different chemists. The first was invented by Dr. Priestley.

EUDIOMETRY is the art of measuring the proportions of oxygen gas in different mixtures, or, in a more extensive signification, of ascertaining the relative quantities of all gases, in their different combinations.

EUDOLITE. A mineral found in Greenland, and remarkable as constituting the second species in in which *zirconia* has been found.

EUKARITE. A mineral which, on being fused, has the smell of horse-radish.

EUPHORBIUM. A gum resin, which exudes from the *euphorbia officin*, a large oriental shrub.

EVAPORATION. The separation of the more from the less volatile parts of any compound substance, by the action of heat and air. It is a chemical operation of frequent occurrence, and one which Nature constantly employs.

GAS BURNERS.

IT has been customary to consume oil gas with the same sort of burners as coal gas, which causes a considerable waste, and gives rise to a mistaken idea of the quantity of light given out by each gas. The Argand burner, which admits the gas through a number of small holes, is the best species for perfect combustion; but, which would hardly have been imagined, it is found that these holes should be nearer together, and smaller, for oil gas than for coal gas. In any case, they should be so far apart that the flame from each should just coalesce with that from the next. The gas produced from oil contains more carbon than that from coal; the light is in proportion to the quantity of carbon, and the same sized holes which completely consume the carbon of the coal gas do not burn all that of the oil gas. It is consequently necessary that burners for oil gas should be made with smaller holes, and these holes should be closer together than those for coal gas.

TO CORRESPONDENTS.

We entertained the same opinions as "G. S." as to the letter of "N. R.," but we should suppose he will think the duty of replying to it is better left in the hands of the person attacked. We have not therefore inserted his letter.

"N. R." will observe he has been in a manner forestalled in his opinionsas to the communication of "Observator." The subject treated of, unless as far as new facts connected with it are brought forward, though of great importance, will not, we think, warrant us in devoting much more of our space to its discussion. We intend therefore to insert only part, if this meets his views, of his letter in our next Number.

"R. L."'s communication in our next.

Does "W. G. H. in the Dark" mean a colour that shall be at one and the same time *dead* and *bright*, as this seems a contradiction; or does he wish to learn how to produce both dead colours and bright colours?

"W. E." Birmingham, is received; the answers must be deferred till the next Number.

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The Chemist.

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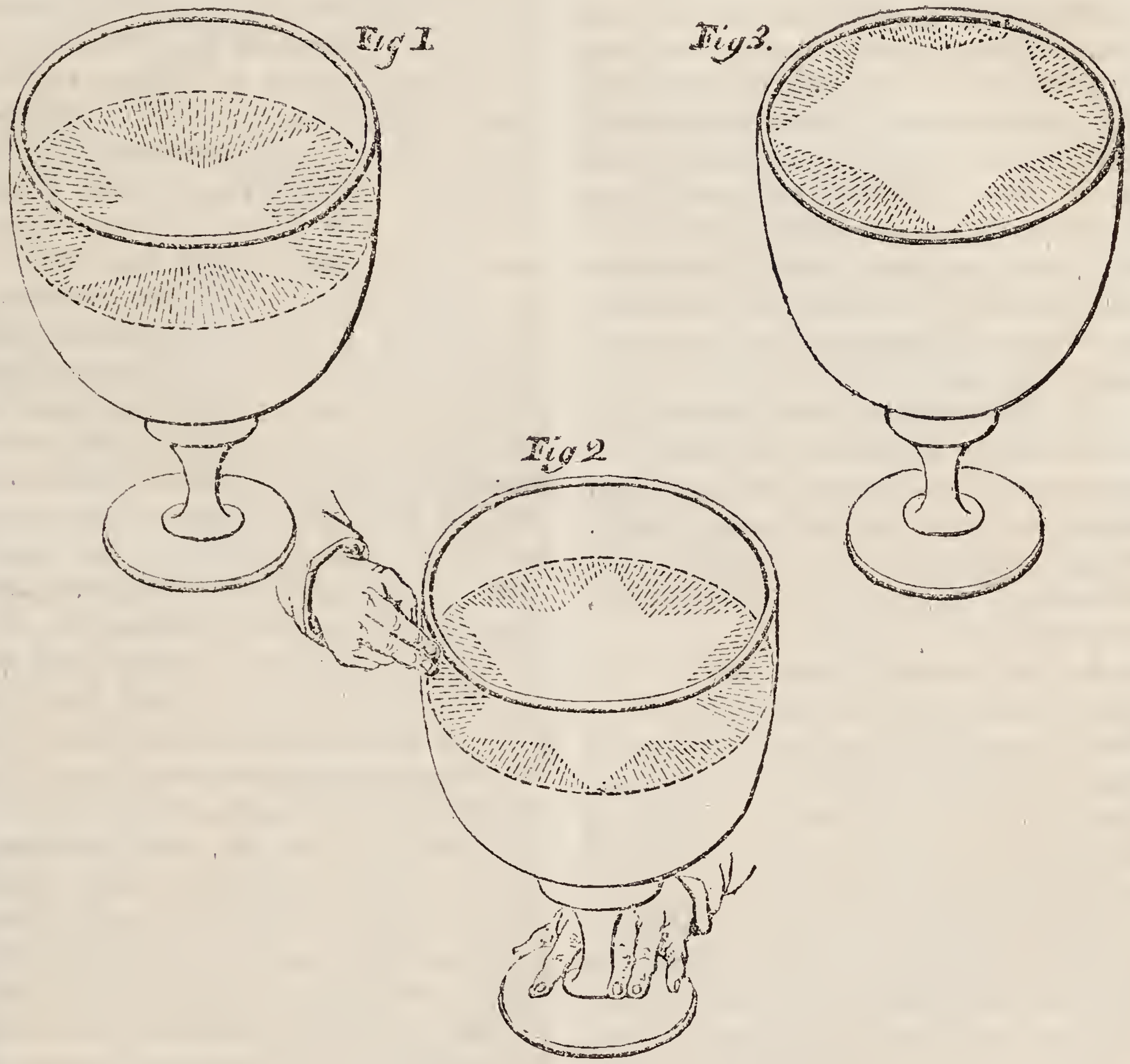

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ACCORDS IN NATURE.

Take a large goblet (the larger the better), and having filled it two-thirds with water, produce a tone from it, by rubbing the hand previously wetted (or a rosined bow) on the outside of the rim, in the manner the musical glasses are played; with this difference, that you confine the friction as much as possible to *one* point until the tone is produced. *Four* points only of the circle of the glass will become agitated, and these of *equal distances* from each other; which points may be distinctly seen by observing the rimpling they make on the surface of the water, as in Fig. 1. If the tone or note be now raised to a fifth from the first, which may easily be done after a little practice, *six* points in the sides of the glass will become agitated, indicating that six portions of the circle are in motion: see Fig. 2. If now you raise the tone to the octave, *eight* points of agitation will be distinctly seen. When the vibrations combine in odd numbers, they give five radii, as in Fig. 3.

A large bell-glass, supported steadily on a foot, is more easily made to produce these different tones by the wet hand than a common goblet, and the rimpling on the surface of the water will be more defined and distinct.

These little experiments show a certain accordance in very different things; or rather we should say, in different parts of the kingdom of nature. It is somewhat remarkable, that the tones which are "to the ear harmony," should also cause those definite and regular forms which are beauty to the eye.

LIFE OF BERTHOLLET.

(*Continued from p.* 252.)

In the subsequent experiments of Berthollet on the decomposition of nitre, phenomena presented themselves of so easy an explanation on the antiphlogistic system, that it seems astonishing how even prejudice itself could avoid the discovery of the true composition of nitric acid. At this time, however, Berthollet *was* prepossessed against the truth, he clung to the old system, and was rewarded accordingly: for the fine discovery that oxygen and azote are the constituents of nitric acid was thereby reserved for Cavendish.

It is unnecessary, however, to detail all the separate difficulties in which Berthollet was involved in common with the highest intellects of his day, from the same cause, that of having the mind previously warped by prejudice. Never was there a system which can bear the test of cool unprejudiced examination less than Stahl's theory of Phlogiston. That Proteus-principle, which performed the most inconsistent and contradictory functions; sometimes possessed of weight, tangible, and easily confinable by the simplest mechanical means; at other times, imponderable, invisible, and eluding all the efforts of the chemist to confine it within the compactest vessels; at other times, possessing even a principle of levity;—the chemical faith of the times, sat enthroned on the understandings of all men of science. And though nothing was more simple than Lavoisier's whole process of reasoning, while no result could be more inevitable than his, the leading doctrines of his theory had been propounded in 1773, and their proofs were nearly complete in 1777; yet they gained no adherent of any note until so late as 1785, when Berthollet became a convert to the truth of the system. It is in a memoir read by him in 1785, on the subject of Oxygenized Muriatic Acid, that he made a full and manly confession of the change which had taken place in his opinions, and in that very memoir combats Guyton de Morveau, one of the most illustrious disciples of the phlogistic school.

Previous to this time, however, M. Berthollet had given to the world several works, all of the highest scientific merit, and some at the same time of great practical value. Thus he was the first per-

son who took an accurate view of the constitution of soaps, in his essay published in 1780, on the Combination of Oils with Alkalies, Earths, and Metallic Oxides. He therein showed that soaps are true chemical compounds, analogous in their nature to salts, and in which the oily principle performs the part of an acid. He also showed that this principle is capable of forming soaps, not merely by combining with the fixed alkalies, potash and soda, but also with the volatile alkali, with the alkaline earths, with the earths proper, with the metallic oxides, and in short with every substance which, in combination with the stronger acids, forms a salt.

The year 1785 was on many accounts a remarkable one in the life of Berthollet. In it he had the honour of being the first French chemist of any note who acceded to the doctrines of Lavoisier: in it he gave to the world his brilliant discovery of the composition of ammonia; and in the course of the same year he published his first essay on the Nature of Dephlogisticated Marine Acid, or Chlorine, thus entering upon a field from which he afterwards reaped so rich a harvest of fame.

In 1780 he showed that a large proportion of azote forms an invariable constituent in every animal substance. He afterwards proceeded a step farther, by making the famous discovery that ammonia is a compound of azote and hydrogen. The only blank remaining to be filled up, with a view to the complete development of animal nature, was the exploring of the nature of nitric acid, which was successfully performed by Berthollet's friend, Cavendish, who showed it to consist of oxygen and azote.* Berthollet was now enabled to form a completely new, simple, and satisfactory theory of the constitution of animal substance, founded entirely on experiment, and accounting easily for every appearance which had hitherto embarrassed the chemist. Animal substances, said he, differ from vegetable, by containing a large proportion of azote as an invariable constituent. During destructive distillation, or during putrefaction, the elements of the complex animal principles are disunited, and in obedience to the new affinities which are thus called into action, unite in new proportions, and form with each other more simple combinations. The azote, at this time disengaged, has a strong tendency to unite with the hydrogen (another invariable constituent of animal substance), the instant it is set free, and the product is ammonia. In a situation favourable to the union of the azote with oxygen, there will also be a formation of nitric acid.

Nothing could be more simple—nothing more complete, than this explanation; and by combining with it the brilliant discovery made shortly before by Cavendish, that water is a compound of oxygen and hydrogen, a lustre was shed abroad upon the science in every quarter, illuminating even those regions over which obscurity had previously hung her deepest shade. In almost every department of chemistry, there had till then been a number of important facts unexplained, and seemingly isolated, but which the intimate relations subsisting between the composition of these three substances served at once to elucidate and to connect.

Lavoisier, Berthollet, Fourcroy, and Guyton de Morveau now combined to plan and organize a new philosophical chemical nomenclature. Such an undertaking had long been a great desideratum, of which every day's experience made the necessity more pressing and imperious. After the important discoveries which had been made, and the many new views which had been introduced into the science, it became a matter of very great difficulty to describe the one or to explain the other in a language

* So simultaneous were these important discoveries in the neighbouring kingdoms, that the private letters of the emulous friends, mutually announcing the discovery of each, are said to have actually passed each other on the way.

which had a constant reference to the phlogistic system.

The imagination can hardly conceive a more barbarous, repulsive, unmeaning chaos, than the chemical nomenclature had for more than a century presented. It was founded by Stahl in 1720, and it is easy to suppose how little the first attempt at methodizing chemical facts, made in the very infancy of the science, would suit the rapid progress of discovery which characterised the 18th century. It retained not a few of the unintelligible terms of the alchemist, and moreover was adapted to the system of Phlogiston, so as to be wholly void of meaning when detached from it. Thus the access to knowledge was rendered unnecessarily thorny and difficult, while the initiated found the science itself proportionally less advanced. Nothing could be more wildly arbitrary than the names then affixed to the various chemical bodies, forming a jargon in which men and gods, beasts, fish, and fowl, and things of the inanimate creation, all found a namesake which the inventor intended according to his varying whim; now as a compliment to heaven, and now as a mark of regard for aught that struck his fancy in or upon the earth. Nay, it would seem that some men of very perverse inclination endeavoured by *the name* to mislead and deceive the uninitiated as to *the thing*;—as it is difficult in any other way to account for a fact such as that three most deadly poisons, the acetate of lead, the chloride of antimony, and the chloride of arsenic respectively, should have been styled the *sugar* of lead, and the *butter* of antimony and of arsenic. In fine, system was unknown,—there was no co-operation, but each in his turn, in this important work, invented for himself; and the greater part of the names thus bestowed have no reference to the subject designated, and are totally independent of methodical arrangement.

Of the great benefits conferred by the new nomenclature on chemistry, it is impossible to doubt and of the philosophical views on which it was constructed and arranged, the success with which for many years it adapted itself perfectly to every improvement in the science, is sufficient evidence. Indeed, it is only within these few years that the new views which have been taken of the nature of chlorine and fluorine, the discovery of iodine and cyanogen, the decomposition of the alkalies, and the electro-chemical theory, having together introduced more enlarged and philosophical ideas of the nature of combustion and of chemical affinity, than were entertained by Lavoisier, Berthollet, and their associates, a corresponding modification of their nomenclature is become necessary. The recent doctrine of chemical equivalents too renders this reform still more requisite, and promises to give a degree of mechanical precision to chemical nomenclature, such as the French chemists could not possibly have imagined or anticipated. The difficulty now is, to bring the leading chemists of Europe to concur in any one method or set of principles in introducing the innovation. Each has his own peculiar ideas on the subject, and for want of some centre of reunion, some mode of having a full discussion of their separate opinions, there is as yet no immediate prospect of even a provisional nomenclature, however much its want may be felt to be injurious to the interests of science.

Berthollet, by his essay on the Composition and Properties of Prussic Acid, gave a striking proof of the independence of a mind which ever judged freely for itself, and thereby often rose superior to the prejudices of the day. It was, as has been previously noticed, one of the doctrines of the theory of Lavoisier, that oxygen is the acidifying principle, and that no acid exists without its presence. So soon as the leading features of this theory began to be received by chemists as correct, an implicit assent to all its details was given

by almost every chemist, save Berthollet. We have already seen that in his memoir on Sulphuretted Hydrogen Gas, in 1778, he stated it to perform all the functions of an acid, and now again, in this Essay on the Nature of Prussic Acid, he found himself enabled, after the successful issue of an analysis, attended by no ordinary difficulties, to declare, that *prussic acid contains no oxygen.* He showed that it nevertheless performs every function of an acid, having affinity for and combining with alkalies, neutralizing them, and forming with them crystallizable compounds, and being again displaced from these combinations by the more powerful acids. The analogy to an unbiassed mind was complete; yet Berthollet's opinion, that acids may exist without the presence of oxygen, gained not a single convert. The new theory now found an implicit acquiescence in its errors, not less unreasonable than the reluctant and tardy assent which had been yielded to its truths. Nay, so undisputed became its authority, even in those points in which each man's own experience should have been his guide, that when Berthollet, nine years after this, again resumed the subject, again investigated the nature of sulphuretted hydrogen, and again confirmed every former statement he had made, though he had long been confessedly one of the first French chemists, again found the same want of success in attempting to establish an important truth which has only commanded general assent since the recent era to which we have already alluded.

(*To be continued.*)

VOLTAIC-MECHANIC POWER.

We had no intention of again adverting to this subject at present; but we are in some measure compelled. An ingenious friend has drawn our attention to No. 51 of the Glasgow Mechanics' Magazine, in which we are indirectly accused of having appropriated to ourselves the invention of another. On turning to No. 43 of this work, published on October 23, in which this invention is recorded, we found the following article:

ON PROPELLING VESSELS BY GALVANISM.

Sir,—A project, relating to the propelling of vessels in water, has occasionally occupied my thoughts for several years, which has for its object a cheaper and more convenient mode than by steam engines; and, lest I should be superseded, in these days of inventions and improvements, I communicate the following outline of my plan for insertion, if you think proper. It is simple, and may be understood without drawings.

The vessel to be propelled is to be converted, under the flooring, into one great galvanic trough, or furnished with a series of smaller ones, according as the one or the other may be proved most efficient in decomposing water; having also a receiver to contain the compound gas, which is known to be pure oxygen and hydrogen, in the proportion that forms water again, when ignited. There is to be a cylinder open at the top, with a piston similar to that of an atmospheric engine; also a condensing vessel immersed in cold water; the cylinder is to have a communication at the lower end, with both the receiver and condensing vessel, with a valve to each. The vessel is to have a narrow platform on each side, with a row of paddles hanging near the sides of the vessel, in a perpendicular position when at rest; the broad part of these paddles is to be as low in the water as the nature of the vessel will permit; the lever or shank of the paddles is to be rather broad and thin at the fore and hinder edges, to move with facility through the water; as they are to move to and fro, like the pendulum of a clock, without leaving the water. The broad, or acting part of the paddles, is to be as far below the surface of the water as possible, and so contrived as to present a thin edge to the water, in moving forward, but to unfold its broad surface in returning or making its effective stroke.

I shall say a few words on the advantage, it is presumed, these reciprocating paddles would possess over the revolving kind at present in use, after describing the operation of the simple apparatus above outlined. I propose to charge the galvanic troughs with sea water, to save the expense of acid; we shall suppose it in action, and the receiver filled with gas; let the valve open into the cylinder, the gas will enter, and raise the piston, which is so connected with the paddles as to move them forward; which done, shut this valve, and open that into the condensing vessel, where the gas is to be

ignited; a vacuum will then be produced under the piston, which will be forced down by the pressure of the atmosphere, causing the paddles to expand and move backwards, making an effective stroke in propelling the vessel forwards; the same process is successively repeated.

It will be observed that the kind of paddles I propose, act on the same principle as wings and fins. A hint from any thing analogous in the works of nature, will generally point out the best principle for any piece of mechanism. There are fishes with fins, with wings, and with sails; but none with paddle-wheels. What has been considered the greatest defect of the latter, is their not all acting at right angles to the surface of the water, and moving parallel to it, which they should do to produce the greatest effect; but I believe a defect, equally great, is their acting at the surface of the water, where its mobility is so great that a considerable part of the power of the engine is spent in making a splutter, and throwing the water into motion, instead of the vessel. The comparative stability of water, at some depth, is well known to seamen, who sometimes retain a boat in its station by letting down a weight attached to a line, and suspending it, though far from the bottom.

I conclude, from these circumstances, that paddles, acting considerably under the surface of the water, would possess great advantage in communicating motion to a vessel. The primary motion of the reciprocating engine corresponding with the kind of paddles I have described, the power spent in working complex machinery would also be saved, and resemble the simplicity and energy with which the muscles of a fish act upon its fins. It may be farther observed, that the fins of the larger fishes are comparatively small, and must have a very rapid motion to cause them to move with their known velocity; which leads to the conclusion that small paddles, with a quick motion, would be more effective than large ones moving slower; and they could be regulated by the engine's length of stroke, and the lever-proportion of the paddles.

The intelligent reader will perceive that there is nothing problematical in the above plan, except the uncertainty whether or not any vessel would afford sufficient space for such an extensive galvanic arrangement as would, by decomposing water, produce gas sufficient to supply the cylinder of a moderate size and single stroke. This point ascertained, *not guessed*, its failure or success might be pronounced with confidence.

Finally, it may be observed, that the paddles now proposed are adapted to any kind of engine, or other moving power, equally with the galvanic engine; and, that their acting silently below the surface of the water, where they will meet a prompt opposition, renders it very probable that a vessel, so propelled, would do as little injury to the banks of canals as if tracked by horses. It is presumed that the broad part of the paddle, acting at any given distance below the surface, would meet with an opposition directly as the distance to which water would spout from the side of a vessel, through an aperture, at the same distance from the surface.

I am, Sir, yours, &c.

Glasgow, G. M.
15*th October*, 1824.

The article on A New Voltaic-Mechanic Power, published in The Chemist, did not appear till November 20, and consequently the merit of priority as to the idea of employing the *decomposition of water by galvanism*, and its recomposition to produce a Mechanic Power, belongs, as far as we are concerned, to the writer in The Glasgow Magazine. We have indeed since been informed that the same idea had occurred long before to a very ingenious gentleman of this metropolis, who had instituted a series of experiments on the subject, and that the merit of having first thought of the subject, does not belong to the writer in The Glasgow Magazine. This point, however, we shall leave to be settled between the writer in the Magazine and this gentleman, if he shall ever think proper to assert his claim, it being enough for our purpose to concede his priority over ourselves. But while we cheerfully acknowledge this, and have now done all in our power to make it known to the public at large, we must solemnly assert, for ourselves, that we never read the paper in the Glasgow Magazine till within this week, and never either heard or saw the least word which could lead us to suppose the idea of a Voltaic-Mechanic Power had previously occurred to any other person. On the contrary, on mentioning the matter to two gentlemen well acquainted with the subject, they assured us, though they both doubted the utility of the project, that it was quite novel. As the writer in The Glasgow Magazine states, it was invented over again. It was from contemplating

the perpetual reproduction of electricity in the *pile,* and seeing the decomposition of water by that electricity, that we were led to suppose Voltaic electricity might be employed as a mechanic agent. Our project was formed in perfect ignorance of the Glasgow man's scheme. We have no wish to plume ourselves with borrowed feathers, or to take, without an acknowledgment, the discoveries of another. We are, indeed, not greatly ambitious of being celebrated as discoverers, because we know that every really valuable discovery belongs at all times more to the age than the individual; and had we known any other person had hit on the same thought as we set forth, we should have been glad to have supported our views by his observations. A man may doubt the feasibility of those projects he himself forms, but when he finds they are also entertained by another, it is a strong reason to believe they are both practical and just. In conclusion, we again deny having had any knowledge whatever of the article we have now inserted till within this week, and claim for ourselves the merit of having, like the author of that article, blundered on a discovery.

ELECTRICAL JARS.

To the Editor of the Chemist.

SIR,—I beg leave to make a few observations in reply to your ingenious correspondent W. G. in your 42d Number. He thinks his plan for an electrical jar *better* than mine. I do not blame him for thinking so, because we are all partial to our own inventions. But I blame him for forming such an opinion before *investigating* how far it is well founded, when the experiment may be so easily made. A jar on my plan may be constructed in much less time and with less trouble than his jars require, and it is therefore easy to ascertain which answers best. His *suspicions* as to the evaporation which he speaks of might have been removed by the same means; and till he had proved the contrary, courtesy required at least a tacit assent to what I have asserted, viz. that the electrical bottle I have constructed, answered "quite as well, and holds as powerful a charge as any other electrical jar, with an equal quantity of coated surface, which I have hitherto tried." Now I will state, for the information of W. G. and others of your correspondents who may interest themselves in the matter, that there is no danger of the electricity being discharged by the condensation of vapour on the sides or neck of the bottle, because, in the first place, there is *no vapour* produced; for it must strike every one in the least degree acquainted with these matters, that no degree of atmospherical heat, which could be borne by an operator, could warm the water sufficiently to create even a slight degree of evaporation, glass being as bad a conductor of caloric as it is of electricity, and therefore it would be a long time before the water in the bottles could acquire the external temperature. In the next place, I have a *proof* as to the point in question, which I think quite conclusive: it is, that *bright* iron wire has been *two years* in these jars as conductors, and, though frequently used, has remained nearly as bright as when first put in,—I mean the part *above* the surface of the water; and in all the instances which have fallen under my observation, no oxidation has taken place, except occasionally in small spots, which I attribute to an accidental splash of the water.* W. G.'s plan is liable to

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* I omitted to add, that a condensation of steam on the inside of the jar is not likely to have the effect of discharging the jar. On the contrary, it has been found that humidity, or a slight degree of moisture, on the inside of a jar, increases the effect. Mr. Brooke and Mr. Cuthbertson are authorities not to be doubted. The latter found that breathing into a dry jar increased its power or capacity of receiving a charge, in the ratio of 12 to 5; and in a dry day in March he found that by breathing through a glass tube into each jar of an electrical battery, it acquired a power of igniting sixty inches of wire, when previously to breathing in it, it only ignited eighteen inches of the same wire!

the same objection which I stated I found applied to iron turnings being used without water. They presented so many *points*, that the electricity was invariably carried off, before a good charge could be obtained. And further, as *cheapness* and facility of construction are the principal advantages of my invention, the use of granulated tin, as recommended by W. G., not having the advantage of cheapness, the method of putting it on not being easy, and the impossibility of obtaining a smooth edge at the upper side, which is indispensable in an electrical jar, make very much against the probability of his method being superior to mine. I have no doubt but a very pretty *scintillating* effect may be produced by coating a clear bottle inside and out in the manner he describes, and I shall avail myself of the hint to construct one upon that principle.

I acknowledge W. G.'s ingenuity, and shall try his plan for a cheap electrical machine, and also a scheme of my own, somewhat different from his, and will, if it appears at all worth the attention of your readers, communicate the results of actual experiments.

I am, &c.

Jan. 8, 1825. TYRO CHEMICUS.

[We shall be glad to hear the result of our Correspondent's labours, as we are quite sure, whether he succeeds or not, the result must be worth knowing. —ED.]

WATER AND ICE PRODUCE FIRE.

THROW a piece of potassium, about as large as a pepper corn, on the surface of water in a basin; the instant the metal meets the water it bursts into flame, with a slight explosion. It continues to burn till the whole of the potassium is consumed, darting from one side of the vessel to the other, or running to and fro on the surface of the water, very rapidly in the form of a red hot fire ball. If a piece of potassium be placed on ice, it instantly takes fire, burns with a bright flame, and melts a deep hole in the ice.

This curious phenomenon is caused by the great affinity which the potassium has for oxygen, in consequence of which it decomposes water and ice, combining with the oxygen with such intensity as to produce heat and light, and setting fire to the hydrogen, which is liberated. The result of the combustion of the metal is the alkali potassa, which is thus shown to be an oxide of the metal potassium.

TO MAKE AN INSTANTANEOUS BLEACHING LIQUID.

PUT a small quantity of red lead into muriatic acid, when chlorine is instantly evolved; add water to the mixture, and then any thing inserted in it will have spots or stains, or its colour even, instantly removed.

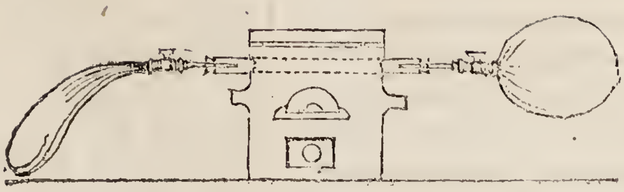
PRESSURE AND RAREFACTION OF THE AIR.

THE pressure of the air, and its rarefaction by heat, are excellently illustrated by the following simple experiment:—Take hold of a wine glass with your right hand, and with your left put into it a small piece of burning paper. When the paper has burned for a few seconds, strike the mouth of the glass against the palm of your left hand, and it will remain firmly fixed to it for a considerable time. The cause of this is, that the internal air is so rarefied by the burning paper, that the pressure upon the inside of the glass is greatly diminished. The equilibrium, therefore, of the pressures upon the outside and inside of the glass being destroyed, the glass must adhere to the hand till that equilibrium is restored.—*Mechanics' Magazine.*

QUERIES.

How to prepare sheep and lambs' skins so as to answer the purposes of rugs, mats, &c.

The best method of extracting or preparing the alkaline poison *atropia* from deadly nightshade.



LECTURES AT THE ROYAL INSTITUTION.

COMPOUNDS OF NITROGEN.

LECTURE 19. NITROUS OXIDE.—After recapitulating what he had before stated of nitrous oxide, the Professor went on to observe, that if the gas were breathed it had a perceptibly sweet taste, but it did not impart that to the water, in which it was very soluble. It is found, however, that a solution of this gas in water, on being set aside and kept for a time, always forms some ammonia. It may be breathed, mixed with atmospheric air, without exciting any peculiar effects; but if it be breathed alone, it produces a species of intoxication, followed by violent muscular motions and convulsions; and, at length, by a lividness of the blood, which is perceptible in the lips, about the eyes, and wherever the colour of the blood can be seen. This gas was first breathed by Sir Humphry Davy, and before that it was supposed to be totally unrespirable. It is now known that it does not extinguish life; but I cannot too strongly caution all those who are at all subject to head-aches, or in any respect to a determination of blood to the head, not to make this experiment, as I have seen one instance, and heard of others, in which breathing it was followed by insensibility for a considerable period, rendering it doubtful whether or not the person would recover. Nothing is more foolish, I think, than for any persons to make such experiments without having some object in view more than the gratification of curiosity. In breathing it, care must be taken that it is quite pure; for if it is mixed with chlorine, as it very often is, it causes very noxious and unpleasant effects.

As another proof of this gas supporting combustion, I may mention that charcoal burns in it, if heated intensely, the same as sulphur and phosphorus. It is also decomposed by being passed through a red hot porcelain tube; and if we press it backwards and forwards from one bladder to the other, [by means of the little contrivance represented in the plate,] it will be converted into nitrogen, and nitric oxide, suffering an increase in bulk. By these sort of experiments we may learn the composition of nitrous oxide. But the best mode of analysing it, is to detonate one volume of it with one volume of hydrogen gas; water is formed, and nitrogen remains. We may do this by mixing one volume of nitrous oxide and one volume of hydrogen over water, and inflaming the mixture with an electric spark: we shall then find that the bulk of the gas is the same as before the mixture with the hydrogen; and as the hydrogen has disappeared, taking with it half its own volume of oxygen, it is thence inferred that the composition of the nitrous oxide is, one proportional nitrogen and one proportional oxygen, or two volumes nitrogen and one of oxygen; the three volumes in the compound being condensed into two. The equivalents then for nitrous oxide are—

nitrogen 14	ox. 8	
		22 nitrous oxide.*

* In a subsequent lecture, Mr. Brande observed that this gas had been condensed into a liquid by pressure, and that about fifty-two atmospheres was necessary for this purpose. It was then a transparent colourless liquid.

Nitric oxide is obtained by exposing dilute nitric acid in a retort, to the action of certain substances, such as filings of copper; an effervescence ensues, and the gas given out is nitric oxide. It is a transparent colourless gas, like air, and not absorbed in any notable quantity by water. When deprived of air, however, water absorbs a quantity, and this solution, after a time, betrays the presence of ammonia. 100 cubic inches weigh 31.77 grains, and its specific gravity is to hydrogen as 15 to 1, it being the mean betwixt nitrogen and oxygen. In this gas then there is no condensation, as in the nitrous oxide. If the student wishes to be very strict in his nomenclature, he may call the former the protoxide, and this the deutoxide of nitrogen. One of its distinguishing characteristics is that of producing red fumes whenever it is exposed to the action of the air. If we uncork a bottle, in which it is contained, such fumes appear immediately. It extinguishes a taper, and also phosphorus, when only moderately heated; but if heated so as to burn with a brilliant white flame, the combustion goes on in this gas, which is decomposed. The red fumes which we see are owing to its absorbing oxygen from the atmosphere, and forming nitrous acid. This gas is not decomposed by a red heat. Charcoal, heated red hot, decomposes it as well as some of the metals. By these means we ascertain its composition; and if we say that nitrous oxide is a compound, one proportional nitrogen and one proportional oxygen, nitric oxide will be a compound of one proportional nitrogen and two proportionals oxygen, the volumes or bulks of the gases being equal. Its equivalent number will therefore be 30, and will be thus represented—

$$\left|\begin{array}{c|c} \text{nitrogen} & \text{ox. } 8 \\ 14 & 8 \end{array}\right| = 30 \text{ nit. oxide.}$$

It has been long known, that when chlorine and nitric oxide are mixed over water, those red fumes arise, which are characteristic of this oxide uniting with oxygen. This is one of the facts which led to the belief that chlorine contained oxygen loosely combined with it. Sir Humphry Davy showed the fallacy of this opinion; and he found that when chlorine and nitric oxide were mixed together on a perfectly dry slab, and in an exhausted vessel, they exerted no action on each other. The oxygen, then, with which the nitric oxide combines, when the chlorine is mixed with it over water, comes from the water, the hydrogen combining with the chlorine, and forming muriatic acid. What it is which thus suddenly disposes the water to decomposition is not exactly known, but it is analogous to the decomposition of the same fluid by zinc and sulphuric acid. It is a mistake, therefore, to suppose the red fumes, from mixing chlorine and nitric oxide, is proof that chlorine contains oxygen; for, in a perfectly dry state, these gases have no action whatever on each other.

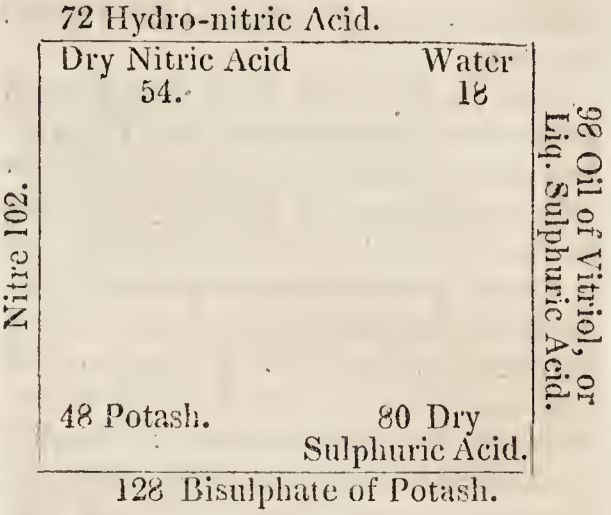
As there are combinations of nitrogen with one and with two proportionals of oxygen, it has also been supposed that there is a compound of one of nitrogen and three of oxygen. This is the opinion of Gay Lussac and Berzelius, and to this compound the name of hyper-nitrous oxide has been given. After a few remarks on the nature of th salts formed with this supposed compound, which we think hardly worth repeating, Mr. Brande concluded, by giving it as his opinion, that there was sufficient reason to believe such a compound existed. He then proceeded to the subject of nitrous acid, which he described as having a far less equivocal existence than the hyper-nitrous oxide. To obtain this acid, as it is absorbed both by mercury and water, we must have recourse to vessels exhausted by the air pump. If we mix two volumes of nitric oxide, and one volume of oxygen, in a vessel so exhausted, we shall find that they combine, and are condensed to about half their original volume. A considerable heat

is evolved, and the product is a deep orange coloured gas. Phosphorus at a high temperature burns in this gas; it is very soluble in water, and the solution has all the properties of an acid. It is composed of one proportional nitrogen and four proportionals oxygen. 100 cubic inches weigh 64.94 grains, and its specific gravity is to air as 21 to 10, to hydrogen as 30.66 to 1. Its equivalent is 46, and it is represented thus—

nitrogen 14	ox. 8	
	8	= nitrous acid 46.
	8	
	8	

The mixture of the nitrous oxide and oxygen serves as a test of the purity of both. If they are mixed over water in the proper proportion, absorption is complete; but if either of them contains uncombined nitrogen, it is not absorbed.

The nature of NITRIC ACID was first accurately pointed out by Mr. Cavendish in the year 1785. By frequently passing an electric spark through common air confined over mercury, and into which a solution of potash had been introduced, he found that, after a time, crystals of nitre, or nitrate of potash, were deposited. The substances were common air and potash; and then he argued that the elements of nitric acid were contained in the air. It is always obtained by the decomposition of some nitrates; and saltpetre or nitrate of potash is generally employed for this purpose. Nothing more is necessary than to place nitre and sulphuric acid in a retort, and distil over, when we obtain a colourless liquid, which is nitric acid. The nitric acid of commerce, which is generally red and fuming, derives these properties from being mixed with a quantity of nitric oxide. It is obtained by using two parts of nitre and one of sulphuric acid. The London Pharmacopœia directs equal weights of these two substances to be used, which, for the perfect decomposition, both of the nitre and of the sulphuric acid, seems most advisable. The diagram, representing the changes which take place, is this:



The 98 of sulphuric acid consist of 80 dry acid and 18 of water; and the 102 nitre, or nitrate of potash, consist of 48 alkali and 54 dry acid; in the decomposition, then, the 80 of dry sulphuric acid combine with the 48 of potash, and form the 128 of bisulphate, which remains in the retort; while the 54 of dry nitric acid being liberated from the potash, combine with the 18 of water, and are condensed into the compound of 72 parts liquid, or hydro-nitric acid. Sulphuric acid contains one proportional of dry acid and one of water, while nitric acid contains one proportional dry acid and two of water: hence the necessity for using an excess of sulphuric acid to obtain pure liquid nitric acid. The manufacturer using a less quantity of sulphuric acid, obtains with his nitric acid a quantity of nitrous acid, which imparts its own colour to his product; he too condenses it in water, while at Apothecaries' Hall it is distilled over. The specific gravity of acid thus obtained is 1.48. If the nitre used is pure, the acid may be obtained pure; but, in general, the manufacturer takes no means to purify his nitre, and the acid of commerce is generally rendered impure, both by muriatic and sulphuric acids. The presence of the former may be detected by the addition of a small quantity of nitrate of silver, when, if muriatic acid be present, the liquid becomes immediately cloudy, and a substance is precipitated. The latter is detected

by a solution of nitrate of baryta. To obtain pure nitric acid, we add these solutions as long as any precipitate takes place, and then distil it over.

Nitric acid is very acrid and corrosive, stains the skin of a yellow colour, which after a time peels off; and then the acid attacks the flesh, destroying it as a caustic. It is easily decomposed by other bodies, particularly combustibles and metals, the oxygen going to the combustible. At 250 the acid boils, and may be distilled over: at —40 it congeals. If exposed to the air it absorbs water from it, and increases in bulk. When quite pure it is at first colourless, but afterwards acquires a straw colour, being partially decomposed by light, and liberating a quantity of nitrous acid. Boiling will drive off this, and the acid will again be found pure. This liquid acid is composed of dry acid and water. As it exists in its dry state in the salts called nitrates, it may be regarded as composed of one proportional nitrogen and five proportionals oxygen, thus—

nitrogen 14	ox. 8
	8
	8
	8
	8

54 is therefore the equivalent of the dry acid, and as each proportional of the acid combines with two proportionals of water each, = 9, we have 72 as the equivalent for the liquid or hydro-nitric acid.

Neither nitric acid by itself, nor muriatic acid by itself, has any effect on gold; but a mixture of the two acids dissolves gold readily. This has long been known, and the mixture was called aqua regia on account of this property. It was observed to become yellow when mixed; and this led to an explanation of the solvent powers of the mixture. A partial decomposition of both acids takes place, the hydrogen of the muriatic acid abstracts oxygen from the nitric acid to form water, and there results, as shown by Sir Humphry Davy, nitrous acid and chlorine, the latter of which possesses in a high degree the power of dissolving gold.

ADULTERATION OF FOOD.

To the Editor of the Chemist.

Sir,—It is a well known ancient adage, that "truth lies at the bottom of a well;" and free discussion is the diving-bell by which that inestimable treasure, so difficult of access, is to be obtained. Under this impression I shall beg leave to offer you a few remarks on the articles by "Observator," which have lately appeared.

Your Correspondent sets out with an observation which I cannot allow to pass unnoticed. He says, "As I presume, from the insertion of his letter, you agree with your correspondent, 'A Confiding Man,' in the justness of his remarks, I have ventured to offer a few observations," &c. But because an Editor inserts a paper, it by no means follows that he agrees with its contents; for he often gives a place to communications directly opposing each other, and cannot, of course, agree with both.

Your Correspondent then observes, "Scarcely a work now issues from the press without a canting and hypocritical preface"! After this, who talks of "sweeping and libellous censures," and "exaggerated and high coloured modes of expression"?

In another sentence he descants most dolorously on "the mischief which such a publication must infallibly produce." I really cannot see what ground there is for making such a fuss; it appears, however, that we are no longer to be kept in the dark with respect to our danger. Heavens! Mr. Observator, what a lamentable occurrence!

In his second letter he complains that Mr. Accum, although declaring the "frauds are so notorious, has not given any intimation of their nature;" and yet, immediately preceding, is a list of adul-

terated articles, copied from the treatise, in which the author explicitly states the substances employed; such as "hog's lard" for "butter," "plaster of Paris" for "paper," &c. I must leave him, to use his own words, "to reconcile these inconsistencies as he can."

Your Correspondent then comes to the butchers, and their practice of "inflating the meat by the breath respired by the lungs." With respect to this he observes, "It is certainly not a very cleanly act, and might be easily accomplished in a less disagreeable way; but we do not expect to find the butchers the best examples of cleanliness"! So, then, we must not be offended at our meat being dirty, because the butchers are dirty fellows! Truly I should say with your Correspondent, "this offers us the very climax of consosation"!

He then proceeds to notice the charges of cruelty brought against the butchers; such as, "keeping the animals without food for three or four days, suspending them by the hind legs for hours, and bleeding them to death slowly, and frequently breaking the leg of a sheep because it is untractable." Although your Correspondent, with his usual accuracy of reasoning, imagines that "the ridiculous absurdity of the last renders it unnecessary to deny the preceding," I apprehend, were he to question a butcher on the subject, he would not attempt to deny them; but he would very fairly retort, that "it is 'rendered indispensable by the consumer;' for nobody would buy red veal, which would be its condition, unless kept without food a few days previously to its being slaughtered." I think the reply of the butcher is just, and that the remedy for this abuse lies with the public.

Before closing my letter, I must be allowed to say, that when a person steps forward to warn the public of the impositions which may be, and are practised by the unprincipled, he deserves, at least, an attentive consideration. And although in some respects he may have been misinformed, and his details, therefore, on some points, not exactly correct, yet if, taken as a whole, he may be generally relied on, he ought to receive those marks of approbation from the public which his services have merited. As such, Fredrick Accum is entitled to our praise rather than our censure.

I am, Sir,
Your obedient Servant,
Jan. 4th. N. R.

EFFECTS OF ELECTRICITY.

To the Editor of The Chemist.

Sir,—The purpose of the present communication is to notice a phenomenon which may furnish matter for speculation to some of your readers; but I shall not venture at present to give an opinion as to its cause. I will simply state the fact, and leave your readers to account for it, hoping to have, through the medium of your pages, an elucidation, from some intelligent electrician, by which my ideas on the subject may be either confirmed or corrected.

On referring to my account of an electrical bottle in No. 40 of The Chemist, it will be seen that I had constructed a battery of twenty-five of these bottles. This battery I lately took to pieces, for the purpose of making some alteration; when, on taking the brass wire out of the centre bottle, I found that the wire, at the *surface* of the water, had collected a quantity of *oxide of iron*, which spread out, in an irregular shape, laterally, on the surface of the water, the greatest width from the wire being about three-quarters of an inch, and diminishing in thickness as it receded from the wire. That part of the wire immediately above the crust of oxide of iron, above described, is of a bluish colour, very much resembling the appearance which a piece of the same wire assumed, when one end had been heated red hot, while all the lower part, which had been constantly immersed in the water, had acquired a colour more

resembling copper, or the metal which is usually called pinchbeck.

I am, &c.

TYRO CHEMICUS.

PROFITS OF COAL GAS.

THE following striking estimate of the cost of a chaldron of coals, and the value of its products, when made into gas, was lately made by Mr. Brande. He observed that it was rather an abstract calculation, and supposed the process to be conducted on strict scientific principles; and perhaps in practice might not be precisely accurate; but the profits must be nearly accordant with this statement:

A chaldron of coals, that at most will not cost above 60*s*., gives, after burning, in consequence of puffing up and swelling, $1\frac{1}{4}$ chaldron of coke, which selling at 26*s*. a chaldron, wholesale price, gives

	£	*s.*	*d.*
	1	12	6
24 gallons of tar, which sells for	0	6	0
12,000 cubic feet of gas sells for	9	0	0
	10	18	6
Interest on capital necessary to erect the works, wear and tear, &c..................	1	11	8
Profit	9	6	10

We are inclined to believe that something has been overlooked in this statement, as to the profits to be derived from the undertaking; but the prodigious increase of value between 60*s*., the cost of a chaldron of coals, and 10*l*. 18*s*. 6*d*., which it will fetch when manufactured, shows admirably the effects of chemical ingenuity and labour, in adding to the wealth of the country.

SIGNS OF CHANGES IN THE WIND.

HAVING frequently amused myself on fine Sunday evenings in Summer with a very large paper kite in order to watch the different currents of wind, I had occasion to notice the following curious fact:—On mounting very high, the kite sometimes got into a different current of air, and the wind usually blew from the same quarter on the earth's surface before the expiration of 24 hours. Thus changes in the wind seem to take place first in the higher regions of the air, and are propagated downwards. I have confirmed this experiment, and established the fact by the use of small air balloons, but the kite answers the purpose quite as well.—*Phil. Mag.*

TO MAKE LEAD CATCH FIRE SPONTANEOUSLY.

TAKE a quantity of tartrate of lead, and put it, with about half the same quantity of charcoal, into a glass tube; expose it to the heat of a small furnace, or a spirit lamp, till it is decomposed and no more gaseous matter escapes. The tube will then be found to contain nothing but lead in a very finely divided state, mixed with charcoal, and this, when spread out in the air, will become spontaneously ignited.

SIR HUMPHRY DAVY's COPPER.

THE account we published in The Chemist, No. 43, of the state of the Samarang's copper, which was taken from a daily paper, has been subsequently denied, and the copper of that ship, defended on Sir Humphry's principle, is found not worse than copper put on ships by the ordinary method, which has been exposed to the same circumstances as that on the Samarang. As an official report will no doubt be soon made on the subject, we shall not again mention it till that has appeared and set the question at rest.

DICTIONARY OF CHEMISTRY.

EXCREMENT has been frequently analyzed, and lately by Berzelius, who found it to consist of water, vegetable and animal remains, bile, albumen, peculiar extractive matter, salts, and slimy matter.

EXTRACT is generally the product of aqueous decoction, carried so far as to afford a substance either solid or of the consistence of paste.

Extractive is a name given to a supposed peculiar vegetable product. Its existence, however, is doubtful.

Eye. This organ consists of the aqueous humour, a clear transparent liquid compound of water, albumen, gelatine, and muriate of soda; of the crystalline lens, containing a larger quantity of water than the aqueous humour, and no muriate; and of the vitreous humour, which in its chemical nature precisely resembles the aqueous humour.

Fat. This animal matter has been, and may easily be separated into two distinct substances; one, called Elain, remains fluid at ordinary temperatures; and the other, called Stearine, which is solid at those temperatures. In The Chemist, No. IV. p. 56, we have described the method of separating these two substances, and their uses.

Fat Lute. Linseed oil and pipeclay made into the consistence of dough.

Feathers consist principally of albumen.

Fecula, *starch;* also a silky green powder, which subsides very slowly from green vegetable solutions; *chlorophyle.*

Felspar. A *genus* in mineralogy, consisting of 4 species and 9 subspecies.

Fermentation is the spontaneous changes, or decomposition, which aqueous combinations of vegetable or animal matters undergo at ordinary temperatures. When vinegar is the result of such a natural change, it is called the acetous fermentation; when wine or beer is the result it is vinous; and when the products are *fetid* gases or ammonia, it is the putrefactive fermentation.

Ferrochyazic Acid. The name given by Mr. Porrett to the peculiar acid which he supposes exists in the compounds called *ferro-cyanates,* or *ferro-prussiates.*

Ferro-cyanates, *ferro-prussiates.* The names given to the compounds of the ferro-cyanic, or, as it is also called, ferro-prussic acid, with bases.

Ferro-cyanic Acid, *ferro-prussic acid,* and *ferruretted chyazic acid,* are all names for the same substance, and which is supposed to consist of the elements of prussic acid combined with one proportional of iron.

Ferrum Ammoniatum, *ens veneris, flores martiales, a muriate of ammonia,* containing a small proportion of iron. It is employed as a medicine.

Fettstein, *ealaolite.*

Fibrin. A peculiar organic compound, found both in vegetables and animals. It is a soft solid, of a greasy appearance, insoluble in water, and in the air it becomes viscid, brown, and semitransparent. It exists in chyle and in the blood. Its ultimate elements are carbon 53.360, azote 19.934, oxygen 19.685, hydrogen 7.021.

Fibrolite. A mineral which is harder than quartz, consisting of alumina 58.25, silica 38, iron and loss 3.75.

Filtration, *straining.* Where great accuracy is required, some chemists reject the use of this operation, and obtain the products by allowing them to subside.

EXTINGUISHING FLAME BY CARBONIC ACID GAS.

To the Editor of The Chemist.

Sir,—There certainly may be objections made to the plan for extinguishing flame by carbonic acid gas, but they are not, as F. S. thinks, insurmountable. 1st, He says, "None of the firemen would approach the building while such a dangerous shower was descending." But if the streams were united, there would be no more danger than from water alone, as the acid would be neutralized by the chalk before it could reach the ground. 2dly. The danger of carry-

ing the acid would be very little: F. S. is not aware that 12lbs. of sulphuric acid, and about double that quantity of chalk, would produce upwards of 1000 gallons of carbonic acid gas. 3dly. The corrosive action on the engine and pipes would be but little, from the dilute state of the acid, and the short time it would remain in them, probably not above five minutes; the pipes being soaked before the acid passes through, and the water rushing through directly after, would not allow time for the acid to do any harm. Neither would the proportion of water to the acid be of much consequence. The best way would be while two engines were at work to put the powdered chalk into one, and the diluted sulphuric acid into the other: and in this way I think the experiment would be worth trying. If there are any objections, as I have no doubt there will be, against using the acid, chalk alone might be tried. I remain

Your obedient Servant,

W. G.

LIGHT PRODUCED BY CRYSTALLIZATION.

Mr. Buchner having mixed some impure benzoic acid, perfectly dry, with the sixth part of its weight of vegetable charcoal, placed it on a soup-plate, which was covered with a cylinder luted to it by almond paste, in such a manner, however, that what took place in the interior could be seen through a hole. After the whole had been exposed for several days to a moderate heat, and some beautiful crystals formed, it was removed to a hotter furnace, and half an hour afterwards Mr. Buchner observed a brilliant flash of light in the interior of the cylinder. A succession of flashes ensued, which completely filled the cylinder, and lasted half an hour, when it was taken off the fire and examined. A grêat quantity of crystals of benzoic acid were deposited. They resembled crystals of the same substance obtained in the usual way, by a more moderate heat and without light, but were less regular. Mr. Buchner attributed this phenomenon to a neutralization of electricity, as it took place at the moment when a crystal was deposited on the inner surface of the cylinder. The same effect has been noticed on crystallizing acetate of potassa, and in preparing oxygen by means of chlorate of potassa and manganese.—*Neues Jour. für Chemie.*

TO CORRESPONDENTS.

"W. E." Birmingham, is informed that the term *chloride* means a binary compound of chlorine and any other element except oxygen, while the term *chlorate* means a compound of chloric acid, (chlorine united with oxygen) and some base, such as the earths, the alkalies, or the metallic oxides. According to the theory at present adopted, the light of electricity is caused by the sudden annihilation of the two opposite states of the electric fluid; and the decomposition of the transparent medium may or may not accompany the light, but is not necessary to it. We are not aware that any experiments have *demonstrated* its identity with solar light, but there is reason to believe they are the same. Water is decomposed by Voltaic electricity, and is converted into hydrogen and oxygen; it conducts common electricity.

In the receipt alluded to by "Discipulus," we suppose *ben oil* is meant; his other requests shall be attended to in our next.

It is not in our power to insert "Observator's" reply this week; and as another Correspondent has made some observations on him in the present Number, he will perhaps make one letter serve for both. At the same time we beg leave to remind him that "*brevity is the soul of wit.*"

We do not exactly understand the suggestion of "A Young Chemist," but, if we are not mistaken, we are afraid it would not be possible for us to act on it.

*** Communications (post paid) to be addressed to the Editor at the Publishers'.

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The Chemist.

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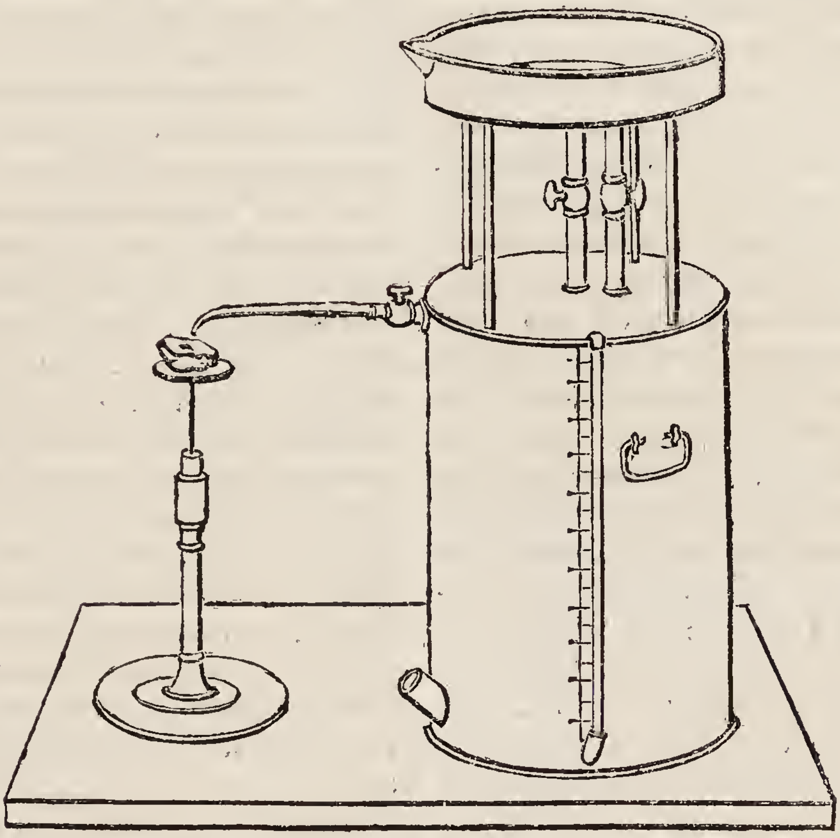

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TO BURN METALS.

THE various ingenious contrivances which the discoveries of chemists have enabled them to introduce into the laboratory have in their turn led to many other important discoveries. After the nature of oxygen was found out, it was soon ascertained that many substances would burn in it which underwent no combustion in common air. It was then applied in different manners to test the combustibility of many substances,

and some of those which were before regarded as the most fixed were easily fused and set on fire. No class of bodies presented in this respect more curious phenomena than the metals; and the best instructed chemists, as well as persons unacquainted with the science, were at first equally astonished when it was found that iron, steel, copper, tin, and most of the other metals could be burnt and dissipated like wood or coal. We have long ago shown our readers the method of burning iron or steel wire in oxygen gas; but the following is a more convenient mode for performing the same experiment, though perhaps the results are not so pleasing:—Lay a small piece of charcoal on a stand, as is seen in the plate; or, which is better, take a stick of charcoal two inches in diameter and a foot long, and make a small hole in it towards one end, holding the other end in the hand; ignite it about the hole by means of a spirit lamp, or a taper and blow-pipe, and then drop into the hole a piece or two of iron, copper, tin, or any other metal. If a small stream of oxygen be now propelled with some force on the charcoal where it is ignited, in a short time the metal will catch fire, and continue to burn till it is all dissipated, or till the stream of oxygen is cut off. The oxygen may be forced from a gasometer provided with a tube, such as is seen in the plate. If this gasometer be used, water must be continually poured into the top, to force out the oxygen; and if it be conveyed through a long upright funnel with a wide top, the pressure will be increased, and the oxygen forced out with with greater power. Or the oxygen may be forced by the pressure of the hands from a common bladder, provided with a narrow brass mouth-piece and a flexible leather tube. The latter may be easily made, or procured at a small expense, and is therefore preferable to the former. By this contrivance, nearly all the common metals, except gold, silver, and platinum, and some chemists say even silver, may be burnt like any common combustible.

LECTURES ON CHEMISTRY AT THE ROYAL INSTITUTION.

CHLORIDE AND IODIDE OF NITROGEN.—AMMONIA.

LECTURE 20. Mr. Brande began by remarking, that he had before exhibited and described the several compounds of nitrogen with oxygen, of which there are five, exhibiting a beautiful illustration of the doctrine of proportionals. In each of these compounds the elements were combined, so as to form exact multiples of each other. The first compound, nitrous oxide, consisted of one proportional nitrogen and one of oxygen; the second, nitric oxide, of one nitrogen and two of oxygen; the third, hyponitrous acid, of one nitrogen and three oxygen; the fourth, nitrous acid, of one nitrogen and four oxygen; and the fifth, nitric acid, of one nitrogen and five oxygen. The latter, indeed, could not be exhibited in an independent or separate state, and was always combined, either with some base, forming salts, or with water, forming liquid nitric acid.

CURIOUS DETONATING COMPOUNDS.—Nitrogen forms one compound also with chlorine, and one with iodine: these substances and their effects were shown at the end of the lecture; but, to avoid repetition, we shall give here what, in fact, was delivered at a later period. Chlorine and nitrogen do not unite directly, but we can procure this compound by exposing a solution of muriate of ammonia to the action of chlorine. If we fill a glass basin with a solution of one part sal ammonia in twelve of water, and place in it inverted a tall glass jar filled with chlorine, the saline solution is gradually absorbed, and rises in the jar: a film forms on its surface, and it acquires a deep yellow colour; at length, small globules, looking like olive oil, collect on its surface, and successively fall into the basin beneath, whence

they may be withdrawn by means of a perfectly clean glass syringe, such as is seen in the plate. It is made of a glass tube, drawn to a pointed orifice, and having a copper wire with a piece of clean tow wrapped round it for a piston. By its means we take a single drop of this oily matter, the chloride of nitrogen, transfer it into a clean common porcelain basin, half filled with water, cover it over with a wire safeguard, to prevent mischief, and then apply to it a piece of phosphorus, fixed to the end of a long stick, and dipped in oil, when it instantly explodes with prodigious violence, shattering the basin to pieces and dispersing the water. This experiment was performed, and the basin broken into a great number of pieces. It is necessary to caution the reader how he handles this substance; he should be very careful that all the vessels he uses are perfectly clean; as grease of any description, and several other substances, cause it instantly to explode. This very curious substance is a compound of one proportional nitrogen and three proportionals chlorine; formerly it was supposed to contain four proportionals of chlorine, but this opinion is now modified. It is thus represented, therefore—

nit.	ch.	ch.	ch.	
14	36	36	36	= 122, being

its equivalent number. From its violent effects care must be taken to operate only on very small quantities.

Nitrogen also forms an explosive compound with iodine; and this substance may be procured by pouring a solution of ammonia on a very small quantity of iodine: the products are hydriodic acid and a brown powder, which detonates on the slightest touch, and is resolved into nitrogen and iodine. It may be collected by pouring off the liquid, and placing it, while moist, on filtering paper, suffering it to dry spontaneously. Some of this powder had been previously prepared, and was brought into the lecture room, lying on two pieces of filtering paper, on each of which there were three small parcels, about the size of a shilling each, and two inches apart. On touching one of these powders with the end of a piece of paper, it instantly exploded, and exploded the other two lying near it. The second piece of paper was then brought over the spot where the first had exploded, and it also exploded immediately with a very loud report, burning the paper into holes. On the explosion taking place, the iodine vapour was distinctly visible—the nitrogen mixing with the atmosphere and disappearing. This substance, when left exposed to air, gradually evaporates. It is a compound of one proportional nitrogen and three proportionals iodine. Neither of these compounds is of any importance, except as a subject of scientific curiosity.

This cannot be said of the compound of hydrogen with nitrogen, which constitutes the volatile alkali ammonia. This substance is obtained by mixing, in a retort, two parts of quick lime and one of muriate of ammonia; and on a gentle heat being applied to the retort, the ammonia passes off in the state of a gas, the muriatic acid of the compound combining with the lime. It must be collected over mercury. At common temperatures and pressure it is a permanently elastic gas. 100 cubic inches weigh 18 grains. It is to air as 5667.* to 1.0000, and to hydrogen as 8.5 to 1.

* Some authors state its specific gravity to air as 59669. In fact, there are several differences on this point, which, as ammonia is easily procured pure, seem to show that it is very difficult to determine specific gravities.

It has been called volatile alkali,† from its volatile nature, and its possessing decidedly alkaline properties. It has a very pungent smell, exciting sneezing; when diluted with air it is agreeable, and is employed to revive and refresh people. It extinguishes flame, though it is itself somewhat combustible, and burns where it is in contact with the air. With air and with oxygen it forms an inflammable mixture. It converts yellow to red, as pieces of litmus paper; and it is distinguished from other alkalies by the colour not being permanent, the yellow being restored as the volatile alkali flies off; though the change, when first produced, is the same as that effected by other alkalies. Water, at the temperature of 50, absorbs 670 times its volume of ammonia. This has been called liquid ammonia, a term which ought to be restricted to the gas, when reduced to a liquid, without being absorbed by water. Mr. Faraday's experiments have taught us, that under a pressure which is equal to 6½ atmospheres, ammonia condenses into a liquid.

It is in a state of solution, or combined with water, that ammonia is most generally used, both in chemistry and in the arts; to obtain it, we may distil the gas over into a Woulfe's bottle, and condense it with water, or we may distil it over already condensed with water. For this purpose, take nine ounces of well burned lime, and slake it with about half a pint of water; add to it, after it has remained in a close vessel for about an hour, 12 ounces of muriate of ammonia reduced to powder, and three pints and a half of boiling water. When the mixture has cooled, pour off the clear solution, and distil over about 20 ounces. This solution, which is sufficiently strong for most purposes, is the liquid ammonia, recommended by the London Pharmacopœia; it has a specific gravity of 960; and it would perhaps be better if the solution were recommended to be made a little stronger, as it is always easily diluted. By absorbing ammonia, the specific gravity of water is diminished; and water containing 32.50 parts per cent of ammonia, has a specific gravity 8750; the solution recommended by the Pharmacopœia, having a specific gravity of 960, contains about 10 per cent of ammonia. Tables of the quantity of ammonia contained in water at different specific gravities have been published, and are to be met with in almost all elementary books.

Liquid ammonia should be preserved in bottles, which are carefully stopped, otherwise the ammonia escapes; at about the temperature of 140, ammonia is rapidly driven off; and at —40 it congeals, and, what is very remarkable, has then no smell whatever.

It was a long time before the composition of ammonia was accurately known, though it had been subjected to a great number of experiments by many eminent chemists. One of the best means of determining its composition is that recommended by Dr. Henry, who first observed that a mixture of ammonia and oxygen gas might be fired by an electric spark. When a succession of sparks is passed through the gas, it increases in bulk, and ceases to be soluble in water. If it be then mixed with oxygen, in proportion to one-third or one-half of its bulk, and an electric spark be passed through the mixture, an explosion takes place, attended by a decrease in bulk. The amount of the diminution divided by three, and the product multiplied by two, shows the quantity of hydrogen contained in the ammonia. From many experiments it has been determined, that ammonia is a compound of nitrogen and hydrogen, in the proportion of one volume nitrogen

† It is to be regretted, we think, that ammonia has no scientific name, formed on the same principles as the names of other substances which unite with hydrogen. In solution it is known by the name of hartshorn, which indicates whence it is procured, but not its nature.

and three volumes hydrogen—the whole four volumes being condensed into two. It is thus represented:

$$\boxed{\begin{array}{c}\text{nitrogen}\\ 14\end{array}}\boxed{\begin{array}{c}\text{hy.}\\ 1\\ \hline 1\\ \hline 1\end{array}} = \boxed{\begin{array}{c}\text{am.}\\ 17\end{array}}$$ and its equivalent is 17.

Ammonia may also be decomposed by passing it through a red hot iron tube, when it is resolved into hydrogen and nitrogen gases. The same little apparatus may be used for this purpose as was described in the last lecture. The bladder is to be filled with ammonia, which by pressure is forced through the iron tube placed in the furnace, but the hydrogen and nitrogen must be collected over water. It may also be decomposed by being passed through a porcelain tube, heated red hot, in the same manner, containing some substance, such as black oxide of manganese, which furnishes an excess of oxygen, when the products are water and nitrous acid gas. This is a curious instance of a change of chemical properties; for we have an alkali entering at one end, and an acid, as one of the results, coming out at the other. In this case the oxygen of the manganese enters into combination with both the hydrogen and nitrogen, forming, with the latter, the nitrous acid gas.

Nitrogen and hydrogen, when mixed, show no disposition to combine with each other; but if they meet when they are just evolved from other substances, or are in, what is called by chemists, a nascent state, they form ammonia. It is on this principle that most of the ammonia of commerce is produced. Bones, clippings of hides, and other refuse animal matters are collected, which, on being subjected to distillation, give out nitrogen; and this, meeting with hydrogen at the moment of being evolved, combines with it and forms ammonia. Ammonia is also formed by the action of nitric acid on iron filings, and on other metals. The salts which are formed by ammonia, combining with acids, may be decomposed by lime, when the smell of ammonia is perceptible, and its existence may by this means be generally demonstrated.

Mr. Brande then proceeded to describe the action of chlorine on ammonia. Scheele was the first person who observed, that when these substances are mixed together muriatic acid is formed. If the two gases be mixed together perfectly dry, in the proportion of 15 parts chlorine and 40 of ammonia, a violent action ensues, attended with with flame, muriatic acid is formed, and nitrogen remains. The best mode of performing this experiment is to fill two wide-mouthed bottles with these gases in the above proportions, placing that with the ammonia undermost, with its mouth upwards, covering it with a piece of plate glass; then place the bottle containing the chlorine with its mouth downwards on the piece of glass covering the other bottle; now remove the glass, the mouths of the two bottles come together, the heavy chlorine and the light ammonia immediately mix with the evolution of flame. This is a very fine experiment, and was dexterously performed.

Mr. Brande then illustrated the formation of sal ammoniac or muriate of ammonia, in which the two gases, muriatic acid and ammonia, when mixed in equal volumes, condense each other into a solid. [This experiment, and the mode of performing it, have already been described in our pages (vol. i. pp.184. 252,) and therefore we shall not repeat it.] The composition of this salt is 1 proportional muriatic acid, 37, and one of ammonia 17, = 54. [Having also more lately described the mode of manufacturing sal ammonia, we shall not repeat Mr. Brande's observations on this subject; neither shall we repeat his remarks on the nitrate of ammonia, as the subject has little in it to interest, further than to remark, that this salt was formerly called *nitrum flammans.*]

WORKMEN THEIR OWN TEACHERS.

The following article is so instructive and so cheering, that we think it cannot be too widely circulated, and therefore we give it a place in our pages. It is abridged from the Glasgow Free Press, and the writer of it is a Mr. D. Bannatyne:

The Gas Light Chartered Company of Glasgow, in which I hold a considerable interest, and of whose Committee of Direction I have for some years been a member, employs constantly between sixty and seventy men in the works. Twelve of these are mechanics, and the others furnace-men and common labourers of different descriptions; forming, altogether, a community not very promising as a body to be incited to adopt measures for their own intellectual improvement. A little more than three years ago, our Manager at the works, Mr. James B. Nelson, proposed to these men to contribute each a small sum monthly, to be laid out in books, to form a library for common use. He informed them, that if they agreed to this, the Company would give them a room to keep the books in; which should be heated and lighted for them in winter; that in this room they might meet every evening throughout the whole year, to read and converse, in place of going to the ale-house, as many of them had been in the practice of doing; that the Company would farther give them a present of five guineas to expend on books, and that the management of the funds, library, and every thing connected with the measure, should be entrusted to a committee of themselves to be named, and renewed by them at fixed periods. With a good deal of persuasion, Mr. Nelson got 14 of the workmen to agree to the plan. A commencement was thus made. For the first two years, until it could be ascertained that the members would have a proper care of the books, it was agreed that they should not take them out of the reading-room, but that they should meet there every evening to peruse them. After this period, however, the members were allowed to take the books home; and last year they met only twice a-week at the reading-room to change them, and converse upon what they had been reading. The increase of the number of subscribers to the library was at first very slow; and at the end of the second year the whole did not amount to thirty. But from conversing with one another twice a-week at the library, upon the acquisitions they had been making, a taste for science, and a desire for information, began to spread among them. They had a little before this got an atlas, which, they say, led them to think of purchasing a pair of globes. And one from among themselves, Alexander Anderson, by trade a joiner, who had the advantage of attending two courses of the lectures in the Andersonian Institution, volunteered, about the beginning of last winter, to explain to them, on the Monday evenings, the use of the globes. Finding himself succeed in doing this, he offered to give them, on the Thursday evenings, an account of some of the principles and processes in mechanics and chemistry, accompanied with a few experiments. This he effected with a simplicity of illustration and usefulness of purpose, that was delightful. He next, and while he was still going on with his lectures, undertook, along with another of of the workmen, to attend in the reading-room, during the other evenings of the week, and teach such of the members as chose it, arithmetic.

For the business of this season, the Members of the Society, who conduct every thing themselves, have made a new arrangement.—The individuals of the Committee have come under an agreement, to give, in rotation, a lecture, either in Chemistry or Mechanics, every Thursday evening; taking Murray for their text-book in the one, and Ferguson in the other. They intimate, a fortnight before, to the person whose turn it is, that he is

to lecture from such a page to such a page of one of these authors. He has, in consequence, these fourteen days to make himself acquainted with his subject, and he is authorised to claim, during that period, the assistance of every Member of the Society, in preparing the chemical experiments, or making the little models of machines for illustrating his discourse. Under this simple system of mutual instruction, which has grown out of the train of circumstances above mentioned, these persons, many of whom, when they joined the Society, were in a state of complete ignorance, have acquired a clearer idea and more perfect knowledge of the subjects which have been brought under their consideration, than would be found to have been attained by any similar number of students, who had been attending the courses of lectures given in the usual way, by the most approved lecturers. The Gas Light Company seeing the beneficial consequences resulting from the instruction of their work-people, have fitted up for them, this winter, a more commodious room to meet in for their lectures, with a small laboratory and workshop attached to it, where they can conduct their experiments, and prepare the models to be used in the lectures. The men, last year, made for themselves an air pump, and an electrifying machine, and some of them are now constantly engaged, during their spare hours, in the laboratory and workshop. The whole workmen, with the exception of about 15, have become Members of the Society, and these have been standing out upon the plea that they cannot read. They are chiefly men from the remote parts of the Highlands, or from Ireland. But the others say to them, join us, and we shall teach you to read; and I have no doubt of their persuading them to do so. The rules of the Society, which have been framed by the Members themselves, are simple and judicious. Every person on becoming a member pays 7*s.* 6*d.* of entry-money. The sum is taken from him by instalments, and is paid back to him again should he leave the gas work, or to his family or heirs should he die. Besides this entrance money, each member contributes three-halfpence weekly, two-thirds of which, by a rule made this year, go to the library, and one-third to the use of the laboratory and workshop. By a rule, made at the same time, which I think a curious indication of the change of feeling produced in these men in the short period since the commencement of the Society, the members may bring to the lectures any of their sons who are above seven and under 21 years of age. The library now contains above 300 volumes. These consist of elementary works of science, and books of history, voyages, travels, some of the standard poets, a few of our best novels, and Shakspeare's works.

ADULTERATION OF FOOD.

To the Editor of the Chemist.

Sir,—I feel obliged by your communication, and will endeavour, by avoiding, as much as possible, "the limbs and outward flourishes," to convince you that the hint conveyed by your quotation has not been lost upon me. "A Lover of Unadulterated Food" has thought proper to consider my remarks on the book as a personal attack on the author. I defy him to point out one expression in any of my letters which would justify him in making such an imputation; and shall only remind him, that the circumstance to which his epithet "fallen" has reference, would not have been overlooked by any one inclined to gratify personal animosity. As to my very acute opponent N. R., I fear he is one of the many who read without "marking, learning, and inwardly digesting." My first observation, which "he cannot allow to pass unnoticed," is certainly of infinite importance, and very much to the purpose. I willingly allow him to enjoy all the gratification which the admission will afford him, and confess my in-

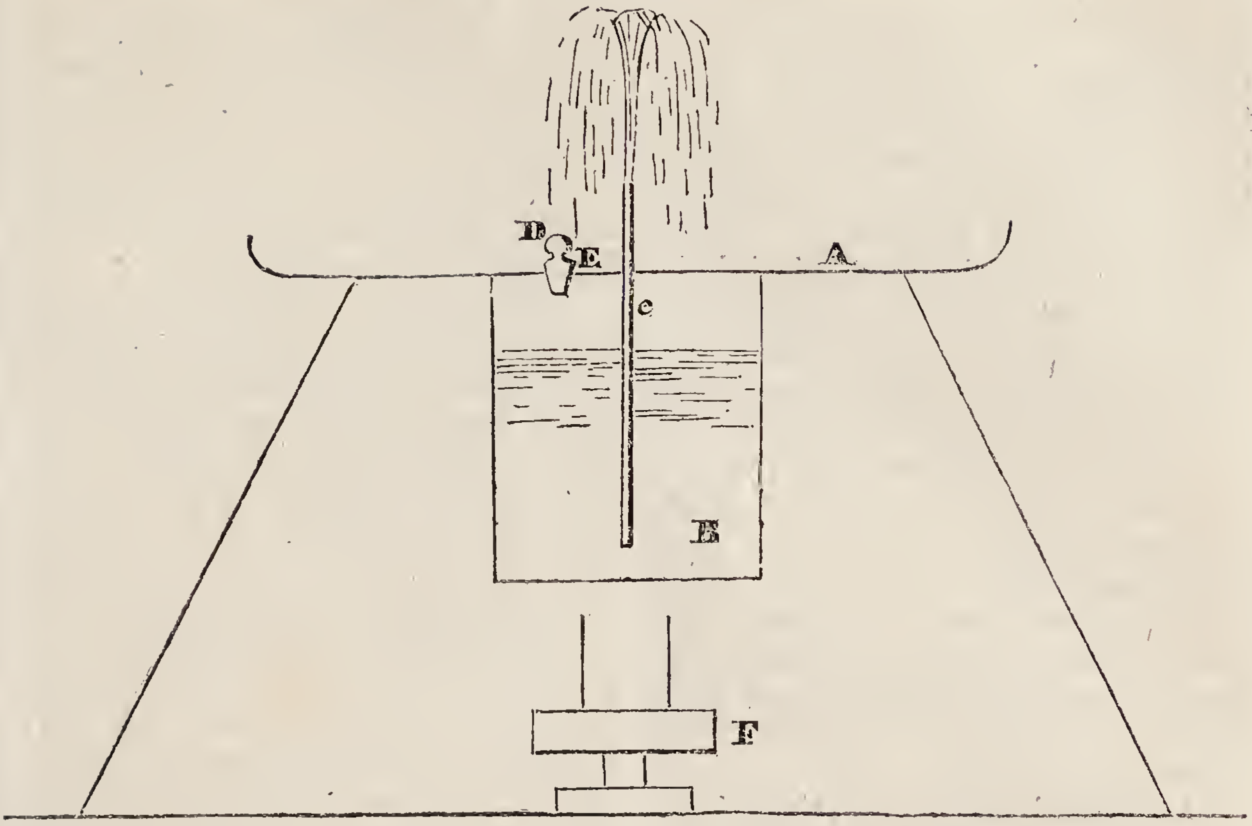
ference was incorrect; and pray, Mr. Editor, do add to his triumph by informing him whether my presumption was incorrect also. The point in his two next remarks (I suppose there is some intended) is rather too deep for my humble capacity. I admit the expressions, "canting and hypocritical preface," and "sweeping and libellous censure;" and am quite as much at a loss to perceive any thing inconsistent or contradictory in them, as I am to find out from what "it appears we are no longer to be kept in the dark with respect to our danger." In the following sentence his meaning is a little more intelligible; the effect, however, is not very creditable to him, for it is a proof, either of the truth of my first suspicion, as to his careless reading, or, what is still more culpable, of a misapplication of my words to suit his own purpose. It evinces great talent and ingenuity to retort one's own words, and the self-complacency with which he chuckles at the idea of having "caught me once upon the hip," is very amusing; but, unfortunately for him, upon reference to my letter, it will be seen, that the charge of not having given us any intimation of the nature of the frauds, was not applied to his "Hog's Lard and Butter," or "Paper and Plaister of Paris," but to the "Tanning of Skins and the Manufacture of Cutlery and Jewellery," of which, all Mr. Accum says, is, that "it exceeds belief." So much for his charge of inconsistency. Equally erroneous is the conclusion he has drawn from my remarks on the practice of the Butchers. "So then (says he) we must not be offended at our meat being dirty, because the butchers are dirty fellows." No one but N. R. would have made such an inference. I only pointed out the falsehood of Mr. A.'s assertion, as to the object of inflating the meat, and exposed, what I still consider, a ridiculous excess of affected delicacy. Had N. R. followed his own advice to me, and "questioned a butcher on the subject," he would have found that Mr. A.'s account of the cruelties committed by them, is as much exaggerated as most of his other statements. It is of this alone which I complain, and of the contradictions into which a too liberal indulgence in it has betrayed him.

"There needs no ghost to tell us" that there *are* knaves in the world—there always have been; and in spite of all Mr. Accum and his disciple N. R. can say or do, there always will be. In conclusion, I shall only observe, that I shall be happy to be convinced, by fair and honourable discussion, of the fallacy of my opinion. I am neither prejudiced nor bigotted, and, "for my own part, shall be glad to learn of noble men;" but I shall not again notice those who, without the shadow of an argument, indulge in unjust imputations, false conclusions, and misrepresentations. Your friend,

OBSERVATOR.

CHEMICAL ORGAN.

TAKE half a dozen, or any number of common bottles, to each of which a cork, with a small glass tube, or tobacco pipe, fixed through the middle, must be closely fitted. Put into each bottle a small quantity of iron filings, or pieces of zinc, and pour on it sulphuric acid, diluted with six times its weight of water; the consequence will be, as the reader knows, that an abundance of hydrogen will be generated in each bottle. Put the cork in each, and set fire to the stream of hydrogen gas which will pass through each pipe or tube. Over the aperture of each suspend other glass tubes of different lengths and diameters; and each of these tubes will produce a very pleasant and different sound, as long as the hydrogen continues to come over, and is kept burning. No one of the tubes should be more than an inch and a half in diameter, nor less than a quarter of an inch. The young chemist, who possesses a fine tact and a skilful hand, may, in this way, construct an instrument that shall give very harmonious, though not varied sounds.



A PARLOUR FOUNTAIN.

To the Editor of the Chemist.

SIR,—I have herewith sent you a description of a fountain, to play by the application of heat, which I think may be amusing to your young readers.

A is a copper basin, soldered to the generator B, which is also of copper; C is a tube with a very small bore, projecting above the edge of the basin A, and reaching nearly to the bottom of the generator; D is an aperture into which the plug E screws perfectly tight; F is a furnace lamp: now when the generator is filled with water and heat applied, steam is formed, which pressing on the surface of the water contained in B, will force a *petit jet d'eau* out of the tube C, and it will continue to play till the water gets below the bottom of the tube. The plug E must then be unscrewed, to allow the water contained in the basin to enter the generator, and then by again screwing the plug and keeping up the heat, the same effects will be produced.

I remain, Sir,
Your Correspondent,
Rotherhithe. R. L.

CONSTITUENTS OF TEA.

THE following experiments, made in the laboratory of the Royal Institution, were chiefly undertaken with a view of ascertaining whether the different effects usually attributed to black and green tea, are referable to any peculiar principle existing in the one which is not to be found in the other. They will tend to throw some light upon the relative composition of teas of different prices. To ascertain the nature and extent of adulterations of any kind is not our present object; the various specimens submitted to examination were obtained from most respectable sources, and undoubtedly genuine as imported; what processes the tea may be submitted to in China, or what mixtures and additions it may there receive, are curious and interesting matters of inquiry, and deserve further investigation than they have as yet received.

EXPERIMENTS WITH BLACK TEA.

One hundred parts of the finest black tea sold in the shops at 12s. per lb. were digested in repeated portions of boiling water until it entirely ceased to act upon the residue; the leaves were then dried,

and were found to have lost thirty-five per cent. in weight; they retained their original colour. The infusion was evaporated, and yielded a dark brown transparent extract, very astringent, and of a nauseous bitter flavour.

The leaves, exhausted of all their matter soluble in water, were digested in alcohol, (sp. gr. 820°,) to which they imparted a deep brown colour, and considerable odour of tea. The alcohol being evaporated, yielded a resinous extract of a more agreeable smell and flavour than that obtained by water. The leaves were now colourless, and without the smallest remaining taste; they were dried, and had sustained a further loss of twelve per cent.

One hundred parts, therefore, of the finest black tea contain forty-seven parts of soluble matter, thirty-five of which are taken up by water, and twelve by alcohol.

A solution of isinglass was carefully added to the aqueous infusion of one hundred grains of the same black tea, as long as it caused a precipitate, which, being dried at a temperature not exceeding 212°, weighed twenty-eight grains.

The above experiments were repeated with a sample of the commonest black tea, sold at 6s. per lb. The weight of the soluble matter imparted to water was precisely similar, nearly thirty-five grains from one hundred; but the leaves, having been exhausted by water, only imparted six grains of soluble matter to alcohol. The flavour of the aqueous extract was nearly the same as that of the former two.

A variety of samples of black tea were submitted to distillation with water, but the distilled water had acquired in all cases a very slight vegetable flavour only; it contained no appreciable quantity of vegetable matter, and was not obviously different from tea of different degrees of excellence.

EXPERIMENTS WITH GREEN TEA.

One hundred parts of fine green tea, digested in repeated portions of water, sustained a loss amounting to forty-one parts; the leaves being separated and dried, still retained a greenish brown colour. The infusion, carefully evaporated, afforded a brown transparent extract, highly astringent and bitter, and having a peculiar flavour unlike that of the original tea.

The residuary leaves of the last experiment were transferred to alcohol, with which they formed a green tincture; when the whole of their soluble matter was thus withdrawn, they were dried, and were then of a pale straw colour, brittle, and quite insipid. They had sustained a further loss of ten parts.

The alcoholic solution being evaporated to dryness, yielded a highly fragrant olive-coloured resinous extract, scarcely acted upon by cold water, but perfectly redissoluble in alcohol. Its solution diluted with water became turbid, and deposited a pale olive-green precipitate, of a slightly bitter flavour, and smelling very strongly of green tea.

One hundred parts, therefore, of the best green tea contain fifty-one parts of soluble matter, forty-one of which, having the properties of tan and extractive, are imparted to water; and ten subsequently abstracted by alcohol, of a resinous nature.

An aqueous infusion of one hundred grains of the same tea was mixed with solution of isinglass; the precipitate, when rendered as dry as possible by a temperature not exceeding 212°, weighed thirty-one grains.

A series of similar experiments were made upon a very inferior sample of green tea, sold at 7s. per lb. This only imparted to water thirty-six per cent. of soluble matter; but the leaves, subsequently digested in alcohol, lost eleven grains; so that the entire soluble contents of the good and bad tea, are to each other as 51 to 47; but as far as the mere agency of water is concerned, as 41 to 36.

Green tea was mixed with water and submitted to slow distillation; the liquid which passed over had acquired a little of the fragrancy

of the tea, especially of the finer samples, but not the smallest portion of essential oil, or other vegetable matter could be detected in it.*

The above experiments show that the quantity of astringent matter precipitable by gelatine is somewhat greater in green than black tea, though the excess is by no means so great as the comparative flavours of the two would lead one to expect. It also appears that the entire quantity of soluble matter is greater in green than in black tea, and that the proportion of extractive matter not precipitable by gelatine is greatest in the latter.

Sulphuric, muriatic, and acetic acids, but especially the first, occasion precipitates in infusions both of black and green tea, which have the properties of combinations of those acids with tan. Both the infusions also yield, as might be expected, abundant black precipitates with solutions of iron; and when mixed with acetate, or more especially with sub-acetate of lead, a bulky buff-coloured matter is separated, leaving the remaining fluid entirely tasteless and colourless. This precipitate was diffused through water, and decomposed by sulphuretted hydrogen; it afforded a solution of tan and extract, but not any trace of any peculiar principle to which certain medical effects of tea, especially of green tea, could be attributed.

One property of strong infusions of tea, belonging equally to black and green, seemed to announce in them the presence of a distinct vegetable principle; namely, that they deposit, as they cool, a brown pulverulent precipitate, which passes through ordinary filters, and can only be collected by deposition and decantation; this precipitate is very slightly soluble in cold water of the temperature of from 50° downwards, but it dissolves with the utmost facility in water of 100° and upwards, forming a pale brown transparent liquid, which furnished abundant precipitate in solutions of isinglass, of sulphate of iron, of muriate of tin, and of acetate of lead; whence it may be inferred to consist of tannin, gallic acid, and extractive matter.

When tea leaves have been exhausted by water repeatedly affused, the above experiments show that alcohol is still capable of extracting a considerable quantity of difficultly soluble matter; this substance, again infused in boiling water, dissolves with difficulty, furnishing a liquid which smells and tastes strongly of tea, and which, were it not for the expense of the solvent and the trouble attending its separation, might perhaps be profitably employed.†

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* "I distilled half-a-pound of the best and most fragrant green tea, with simple water, and drew off an ounce of very odorous and pellucid water, free from oil, and which, on trial, showed no signs of astringency."—LETTSOM's *Natural History of the Tea Tree*, London, 1799, 4to.

Some of Dr. Lettsom's experiments would seem to show that the noxious effects of tea are referable to the volatile and odorous principle which thus passes off in distillation; and he thinks that those who suffer from them, but yet cannot omit this favourite beverage, might take it with more safety if previously boiled for a few minutes to dissipate the fragrant principle. In all the forms which Du Halde relates for administering tea as a stomachic medicine among the Chinese, it is either ordered to be boiled, or otherwise so prepared as to dissipate its fragrancy.

† This is, we think, a very useful suggestion. It is true, that the solvent is expensive; but there is no doubt brandy, rum, whiskey, and any of the more ordinary forms of alcohol might answer that purpose, and then the solvent would be enriched by all that it could extract from the tea. There is reason to believe, also, that spirit which had dissolved the better part of the tea, and was then diluted with water, would make a more refreshing drink than almost any we now possess. An illustrious personage seems long ago to have made this discovery, and Regent's Punch, which is celebrated in the annals of good drinking, was in some measure an infusion of tea in alcohol. A similar punch is drunk in considerable quantities at Paris and in other cities on the Continent; and its very enlivening effects are accounted for by the power of the spirit to dissolve a much greater quantity of the inspiring part of the tea than water.

Though the above experiments show that tea contains, upon an average, from thirty to forty per cent. of matter soluble in boiling water, it is not to be supposed that so large a proportion is taken up in the ordinary process of making tea; on the contrary, from tea leaves in the state in which they are usually thrown away, there is still contained from ten to fourteen per cent. of soluble matter, capable of affording a sufficiently pleasant beverage, thought it must be granted that the most agreeable portion of the tea, consisting probably of the purer tannin, or astringent matter, and of the whole of the aroma, is taken up by the first affusion of hot water; and that, subsequently, the bitter and less soluble extractive matter are dissolved, furnishing what is usually called *strong tea*, but infinitely less agreeable than the earlier infusion. Hence it is that the real epicure in this article imitates, in some measure, the Chinese process of infusion; and only drinks the first made tea, using a fresh, but small proportion of the leaves for each successive cup.

The following table shows the respective quantities of soluble matter in water and in alcohol, the weight of the precipitate by isinglass, and the proportion of inert woody fibre in green and black tea of various prices; it is given, not as throwing any important light upon the cause of the different qualities of tea, but as containing the results of actual experiments; it may also perhaps save some trouble to future inquirers.

One Hundred parts of Tea.		Soluble in Water.	Soluble in Alcohol.	Precipitate with gelly.	Inert residue.
Green Hyson,	14s. per lb.	41	44	31	56
Ditto,	12s.	34	43	29	57
Ditto,	10s.	36	43	26	57
Ditto,	8s.	36	42	25	58
Ditto,	7s.	31	41	24	59
Black Souchong,	12s.	35	36	28	64
Ditto,	10s.	34	37	28	63
Ditto,	8s.	37	35	28	63
Ditto,	7s.	36	35	24	64
Ditto,	6s.	35	31	23	65

Journal of Science.

PRECIPITATION OF LOGWOOD.

Mr. Investigator,—Observing your Query in The Chemist, No. XXXIV., respecting the cause of logwood, or more properly a decocted solution of its colouring principle, being precipitated on the addition of sulphate of alumina, and leaving but a small portion of colour in the solvent, (water, I presume,) I beg to call your attention to Nicholson's short Treatise on the action which several substances have upon a decoction of logwood, *hematoxylum campechianum*. He observes, "Alum (al. sulph.) produces a pretty copious precipitate of a lightish violet colour, the liquor remaining violet and nearly transparent." You say, further, that on the addition of a few drops of sulphuric acid, the liquor became too red for use, although the coalition was restored. On the addition of sulphuric acid to any vegetable decoction of a purple colour, a precipitate is formed, which, with the supernatant liquor, becomes a dark red. I think, if the result of your experiment had been set aside a few hours, you would have perceived a precipitate, which I imagine would have been more copious, the liquor having been previously affected by

the sulphate of alumina. To remedy the effect of sulphuric acid, you introduced carbonate of soda; its operation would of course be according to its quantity, and if my chemical ideas be correct, would form a triple salt, composed of alumina, soda, and sulphuric acid, which I would call an aluminous sulphate of soda. How far I may be correct in this particular is left for the decision of more able chemists than your juvenile correspondent.

Having thus far partially elucidated the surprising phenomena which took place during your philosophical experiments, I shall conclude by saying, it is a principle common to sulphuric acid, and most of its salts, to precipitate vegetable colour. More satisfactory information might have been given had you informed me what was the object of your experiments.

If the above is deemed worthy of insertion in The Chemist, the Editor will much oblige his constant reader,

L. T. jun.

SLIDES FOR MAGIC LANTERNS.

To the Editor of The Chemist.

Sir,—The following simple method of making slides for magic lanterns is, I believe, of my own invention. I do not, however, exactly lay any strong claims to it, as it is possible some other person may have practised it; but as I have never seen any thing at all like it, I think I may fairly conclude that it will be new to many of your readers.

Take some good tracing paper, trace your figures, &c. in ink; colour them with water colours, in the same way you would a common water colour drawing, only observing that the colours must be very vivid; take a slip of glass, and gum it well over; then lay on your tracing paper, with the coloured side of the figures next the glass; rub it down smooth with your hand, first laying some softish paper over it, and when dry, if the drawing is well executed, you will have a slide to answer, if not quite, at least nearly as well as those purchased at the opticians'.

I am, Sir,
Your humble servant,
Jan. 10. Opticus.

CANDLES SHOULD NOT BE KEPT UPRIGHT.

The common method of burning candles, by placing them in a perpendicular position, seems, from the following paper, to be disadvantageous. The author of The Technical Repository, from which work we extract it, says, that dipped candles are preferable to mould candles for burning in an inclined position. Using these, and taking the following precautions, it will be found that the upright is not the best position for burning candles—

In the first place, to prevent any liability of the melted tallow overflowing, the candle ought not to be inclined until the wick has acquired some length, from the burning of the candle, when in its usual erect position.

Under favourable circumstances, and in a still atmosphere, a candle will generally continue to burn, until it is consumed within half or three-quarters of an inch of the socket of the candlestick; when, unless raised, the tallow will begin to overflow, owing to the free access of air being partly cut off by the projection of the cup around the socket: it will, consequently, burn without snuffing, and with a constant light, nearly equal to that of a candle when just snuffed, for several hours; the end of the wick crumbling to ashes, beyond the bounds of the flame.

But these are not all the advantages; for, as the combustion is perfect, from the freedom with which the air strikes the flame from beneath, without being impeded by the surrounding tallow as in using candles when placed upright, so no smoke is formed, and the candle becomes an exceedingly useful and cheap substitute for the spirit-lamp, in performing many small chemical operations.

We find an angle of about 45° a very proper one for adjusting the candle. Candlesticks have been made on purpose to give the candle any required position: but there is, however, no difficulty in so propping and adjusting an ordinary candlestick, especially one not too high, and with a square foot.

In the case, however, of thus using two candles on the same table, care should be taken that the flames do not approximate; as the tallow would inevitably become softened, and the candles gutter or overflow.

We have hitherto found these precautions quite sufficient to ensure success, with common candles, for writing or reading, without being continually interrupted by the necessity of snuffing.

EFFECTS OF HYDROGEN ON THE VOICE.

It is a well known fact, that all sounds, and, consequently, those emitted by our organs of speech, depend on the density or rarity of the atmosphere for their loudness or feebleness. Thus, Gay Lussac and M. Biot, who ascended in a balloon upwards of 23,000 feet, found, at that height, that they could not make each other hear. The utmost exertion of their lungs only produced a sound like a whisper. So, also, when Dr. Halley descended in the diving bell, to a depth at which the air was compressed by a force equal to two atmospheres, he found the lightest word quite intolerable. The voice of his companion was much louder than usual, and gave him considerable pain. Although no other air can be breathed for any length of time but the atmosphere, there are several gases which differ in their density from atmospheric air, and may therefore be employed to produce the same effect, as ascending to the upper regions or descending under the sea. Hydrogen is frequently thus employed. It may be breathed for a short time; and, when taken into the lungs, causes, on speaking, a strange alteration in the voice. A very little is sufficient to make a perceptible change; and it is only necessary to inhale hydrogen from the bottle where it is produced, and immediately speak, when the alteration in the voice is quite astonishing.

DICTIONARY OF CHEMISTRY.

Finery. The name of the furnace in which cast iron is converted into malleable iron.

Fiorite, *pearl sinter*, *amiatiti.* A mineral more known on account of the controversies it has occasioned than for any valuable properties it possesses.

Fire. The common name for combustion attended with flame.

Fire Damp, *carburetted hydrogen.*

Fish Scales consist of alternate layers of membrane and phosphate of lime.

Fixed Air, *carbonic acid gas.*

Fixity. The property possessed by some bodies of remaining unaltered when exposed to heat.

Flake White, *oxide of bismuth.*

Flame, *luminous gas.*

Flesh. The common name for the muscles and fat of animals.

Flint. A well-known stone, consisting of 98 silica, 0.50 lime, 0.25 alumina, 0.25 oxide of iron. It is found in most parts of the world, and is used for gun-flints, in the manufactory of porcelain and glass, and by chemists for mortars.

Flinty Slate, *lydianstone.* These two names distinguish two species; the former is very common and well known, the latter is used as a touch-stone for ascertaining the purity of gold and silver.

Float Stone, *indivisible quartz*, *spongiform quartz.* A mineral which occurs encrusting flints, and consisting of 98 silica, 2 carbonate of lime.

Flocky Rocks. Mineral formations of the secondary kind, or of that kind which, according to the

theory of Werner, has been deposited from a fluid. They consist generally of strata parallel to each other, and very often horizontal.

Flores Martiales, *ens veneris.*

Flos Ferri. A radiated variety of carbonate of lime.

Flowers. A term used by the elder chemists to signify the solid and flaky matters which resulted from sublimation; thus there were *flowers of sulphur, flowers of antimony*, &c.

Fluates. The salts which are formed by the union of fluoric acid with the different bases.

Fluate of Lime, *fluor spar.*

Fluidity. When bodies have a tendency to spread themselves in all directions except upwards, or when their different parts move readily in all directions with respect to each other, they are called fluids. They are distinguished from gases by the latter having a tendency also to spread upwards, or expand themselves in *all* directions.

Fluoborates. Compounds of different bases with

Fluoboric Acid, which is supposed to be a compound of *fluorine* and *boron.* It is a gaseous body, acting with great energy on all vegetable and animal matters, depriving them instantly of moisture and hydrogen.

REPLY TO QUERIES.

To the Editor of The Chemist.

Sir,—In your last Number, a Correspondent inquires for the best method of making a permanent black writing ink, and good jet blacking. The following receipts will, I apprehend, be found satisfactory.

First, to make ink: Infuse 12 oz. of blue galls, well bruised, in a gallon of soft water, let them remain three weeks, stirring daily; then add to the mixture—

Ground logwood..6 oz
Gum Arabic ....6 ..
Brandy ....1 wine glass.

Boil these one hour. Four ounces of sulphate of iron must then be added, boil ten minutes longer, strain the liquor, bottle it, and it is fit for use.

Now for the blacking:—

Ivory black........	8 oz.
Treacle...........	8
Sweet oil..........	1
Sulphuric acid.....	1
Vinegar	3 pints,

Put on, and rubbed till dry.

As injury to the leather is particularly deprecated, the oil of vitriol may perhaps be an objection; in that case take the following—

Ivory black	4 oz.
Coarse sugar	3
Sweet oil	0½
Small beer	1 pint.

Mix them gradually, cold.

Should your Correspondent wish for a blacking which cannot injure the leather, and will require less trouble in its application than any other, let him try the following—

Dissolve 3 oz. of gum arabic in one pint of ink; lay on this composition with a sponge; it will dry in less than a minute, without the application of any brush. It is, I believe, principally used for ladies shoes, being rather expensive.

I am, Sir,
Your obedient Servant,
Jan. 12. N. R.

THE WATER HAMMER.

Writers on mechanical philosophy say, that the particles both of air and water are hard; and they prove it, as to air, by exhausting a glass covered with a piece of bladder; on breaking the bladder, the air rushes in, and, impinging against the glass, gives a perceptible sound. It is proved more certainly with water, by an ingenious instrument called the Water Hammer, and which may thus be made: Put a small quantity of water, not exceeding the sixth part of the capacity of the instrument, into a glass tube, with or without a bulb at the end. Boil the water by a spirit lamp, or any other means, till about the half is evaporated, and

then seal the upper end of the tube at the blow-pipe. Remove it from the fire, and, on acquiring the temperature of the surrounding atmosphere, the water, when made to fall suddenly to either end of the tube, will give a sound, as if the glass were struck by a piece of metal.

QUERY.

The best method of gilding trinkets so that the gold may be either burnished, chased, or dull, or, as it is called, dead.

TO SPLIT LARGE STONES.

Kindle a fire on the upper surface, which being expanded by the heat, the stone splits. The hardest and largest stones may be split by this method, continuing the fire and increasing the heat in proportion to their size.

MEANS OF SEPARATING TYPES.

It often happens that printing characters, particularly small ones, are united together in the casting, to the great increase of the expense of the whole. By the following method, these types may be separated: — The agglomerated characters are to be immersed in river water for two days, so as to be entirely covered by it. They are then to be boiled in water containing one per cent. of its weight of potassa. After a short time they are to be taken from the liquid, the blocks are to be laid on a table, and when struck lightly by the hand they are found to separate very easily from one another. This process is very simple, and not expensive, and may be advantageously employed to separate types after impressions have been taken and they are removed from the form, when, as is well known, they often adhere firmly together, and are separated by being washed with a solution of potash.

TO CORRESPONDENTS.

"W. R. G." will find much of the information he wants in The Chemist, vol. i. pages 317, 329, 345, 361. The accident he mentions is always prevented, both on the large and small scale, by a tube of safety. In the plate at p. 361, the middle tube of the earthen vessel answers this purpose. There is another mode of making sulphuric acid than those we have already described, namely—making it from pyrites, as is practised by Mr. Hill, at Bromley. This method will be described in our pages in a short time. Soda, or rather carbonate of soda, may be obtained from the *sulphate* by calcination with charcoal and chalk, in a reverberatory furnace.

The mineral sent us by "Discipulus" evidently consists of two distinct substances, one crystallized and in nodules, and enveloped in another, which consists of the agglomeration of numerous particles and small crystals of different substances. The former are small flints, the latter consist principally of silica and lime. We cannot compress into a note an account of the method of analyzing minerals, but such an account will ere long appear in our pages.

"Davidis" will see, from the articles "*Cheap Electrical Jars*," in our Numbers 40 and 42, that common glass answers very well for electrical jars. This is our only reason for not inserting his letter, as we think with him, that caprice has had much to do with the selection in question. We shall be glad to hear again from him.

Being still somewhat in the dark as to the request of "W. S. H." we have inserted his query, but are not quite sure that we have rightly expressed it.—Trinkets, after being gilt, have, we believe, rarely any colour imparted to them: their beauty consists in the colour of the gold.

*** Communications (post paid) to be addressed to the Editor at the Publishers'.

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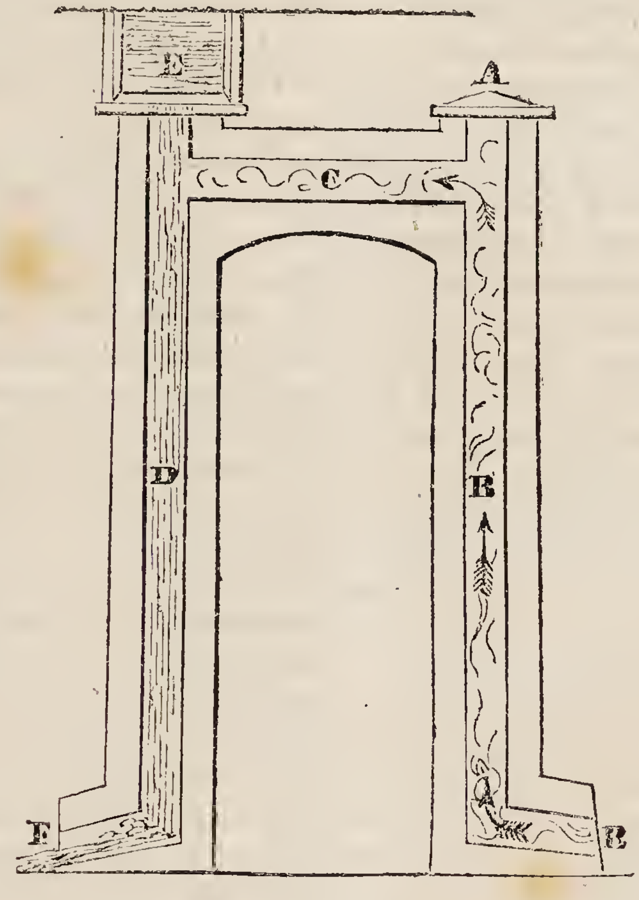

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METHOD FOR CONDENSING SMOKE, ETC.

The following is a description of Mr. Jeffreys' (of Bristol) plan for condensing smoke and metallic vapours, so as to completely prevent them finding their way into the atmosphere. So much as the inha-

bitants of this metropolis are annoyed by smoke, we should suppose they would find it for their interest that some plan like this should be generally adopted. The plate is meant to represent a vertical section of the contrivance, and with the description it will, we hope, be understood. We must add, that we take it from the Quarterly Journal:—

The letters BB, are intended to point out a flue by which the smoke from a furnace, applied to any ordinary purpose, is carried off. By Mr. Jeffreys' plan, the top of this flue is closed up, as at A, and the smoke, &c. pass, by a lateral communication, which is here represented by the horizontal flue C, into another chimney or flue D. On the top of this flue D is fixed a cistern E, the bottom of which is perforated with holes, the size of which will necessarily vary according to existing circumstances, but they should spread over the bottom of the cistern to an extent equal to the area of the flue D, that the shower of water which is perpetually passing down from the cistern, may be equally diffused throughout. The cistern, of course, receives a supply of water equal to the expenditure through the holes in its bottom. The shower, in its descent, carries down with it the smoke, and all the sublimed matter which has passed from the fire, in the direction pointed out by the arrows, and the whole, thus condensed, runs off from the flue D, at the opening F.

Although the drawing gives the lateral communication between the flues B and D in the manner described, it will be obvious, on reflection, that these flues may stand so close to each other as only to be separated by a party wall. Or D may stand at any and almost an unlimited distance from B (which may run in any direction that may be found convenient) without lessening the draught of air, provided that the matters which pass through it enter the flue D immediately under the cistern E, with a view to make the condensation by the shower of water as complete as possible.

When it is considered that water and air have a mutual attraction for each other; that all bodies expanded by heat, are contracted by cold; and that the motion of bodies in falling, is accelerated as the distance they fall through is increased, it must be evident, that by a due attention to these several causes, and a proper application of them, such a current of atmospheric air may be made to pass through a furnace, as, perhaps, was never yet attained.

It was not this application of the principle that first suggested the idea of effecting condensation by this mode, but in seeking a remedy for the baneful effects produced by arsenical and sulphureous vapours, sublimed metals, and other matters which spread so widely in all directions, around those works where the smelting of metals is carried on.

Though it is hoped the public may derive advantage in various ways from the application of this invention, and, more especially, where the expense of carrying it into effect bears but a small proportion to the advantages that will accrue, still it may be expected that many instances will be found, in which the difficulty or the expense of procuring the necessary supply of water, and possibly, other causes, will operate as a total bar to its adoption. On the other hand, it is not improbable, that time and reflection may discover remedies, which, at the outset, may not occur.

Bristol, November 1824.

N. B. Mr. Jeffreys has taken out a Patent for this Invention ; and we understand that its efficacy has been very satisfactorily proved by experiment. The draught of air through the furnace was prodigiously increased; and although the ascending column of smoke was rendered as dense and black as it could well be made, yet not a particle of smut or smoke was observed to escape by the vent at the bottom of

the water-flue. A strong current of air, and a stream of *black* water issued forth, but nothing like smoke.—*Quarterly Journal of Science.*

LECTURES AT THE ROYAL INSTITUTION.

ATMOSPHERIC AIR.

Lecture 21. Atmospheric air has necessarily excited a great deal of attention from its importance, and a difference of opinion has existed whether it be a chemical compound, or only a mechanical mixture of the two gases, nitrogen and oxygen, of which it principally consists. The uniformity of the proportions in which its elements are always combined, seem to give weight to the former opinion. But if we mix the same proportions of these elements, they seem to suffer no chemical combination, there is no visible chemical action, and yet the mixture has all the properties of atmospheric air. In these circumstances there is something not fully explained or accounted for.

There are some of the mechanical properties of air with which the chemist has much to do, and there is one in particular, a very nice operation, which he is constantly called on to perform. This is to determine the specific gravity of gases, which has an intimate connexion with the specific gravity of the atmosphere. There were formerly various opinions as to the nature of the medium which surrounds the globe, and it was supposed to be an exhalation destitute of weight. Galileo was the first person who suspected that it possessed gravity, and who proved that it did. He found that a copper ball, in which the air had been condensed, so as to equal three or four atmospheres, weighed considerably heavier than in its ordinary state. The subject attracted the attention of Torricelli about the year 1642 or 1643, and he ascertained the point more completely. In an attempt made at Florence to raise water to a considerable height, it was found, that though the pumps continued to work, it only rose as high as 33 feet. Torricelli suspected that this arose from the pressure of the atmosphere; and he concluded, if this were the case, that a fluid much heavier than water would not rise so high. He chose quicksilver for the subject of his experiment, and calculated, that in proportion to its greater density it ought to rise only about 30 inches. He accordingly filled a tube about 36 inches in length with mercury, and he inverted it over a basin of the same substance, and the mercury sank in the tube, leaving a vacant space above it about six inches in length. Thus it was proved, that it is not because nature abhorred a vacuum,* as it has been supposed, that water rises in the pump, for here was a perfect vacuum, which the mercury did not rise to fill, but the water rises from the pressure of the atmosphere. Torricelli proved that the weight of the atmosphere was equivalent to about

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* We may here remark, that Mr. Brande, in speaking of the vacuum produced by an air pump, in a subsequent part of his lecture, observed, that, by this instrument, we only exhausted the air to a certain degree proportioned to its electricity, and that there would be still in the most perfect vacuum some portion of attenuated matter. In the Torricellian vacuum there is the vapour of mercury. It would therefore seem, that nature does, in fact, abhor a vacuum, taking this as the figurative expression for the circumstance, that we cannot have space without matter. To us it seems that there is something unexplained. If we suppose a tube forty feet long, filled with water, and immersed, inverted, in that fluid, the water will fall to 33 feet, and the upper 7 feet of the tube will be filled with its vapour; if we treat mercury in the same way, we shall find that it falls to 30 inches, and the upper part of all the 40 feet will be filled with its vapour. The circumstance which perhaps requires explanation, is the tendency of the water to become vapour at the height of 33 feet, while the mercury has that tendency at the height of only 29 inches. This difference has a fixed and determinate relation we know to the difference with which both these bodies tend towards the centre of the earth, or their gravity; but why do not the mercury and water expand and fill the tube? and why do they at these particular heights form vapour?

15lbs. on every square inch. As this pressure diminishes in proportion as the column of air is shortened, as we ascend, the barometer furnishes us with a means of measuring heights. At one thousand feet above the surface the pressure is diminished about one inch; and at the height of twenty miles, supposing the whole height of the atmosphere to be 40 miles, the mercury will not stand above 95. 100th parts of an inch. Mr. Brande then entered into an explanation of the principles of air pumps, and showed their construction, as well as exhibited several experiments on the pressure of the atmosphere; but as most of these matters are, we believe, familiar to our readers, we shall not follow the Professor. He afterwards described the mode of determining the specific gravity of gases, and of ascertaining the quantity of oxygen in atmospheric air; and on these two parts of the subject we shall only lightly touch.

To ascertain the specific gravity of gases, we must be provided with an accurate balance; that possessed by the Royal Institution is made after one constructed by the late Mr. Ramsden for the Royal Society, and is affected by the thousandth part of a grain, when weighing only 100 grains. There are some objections to this particular species of balance; but, on the whole, it answers very well for this purpose, and possesses the advantage of enabling the operator to weigh with it very considerable weights. We must also have some very thin light flasks, capped with thin brass, and furnished with stop cocks. Florence flasks answer for this purpose. The gases to be weighed should be contained in a vessel, on which a scale is graduated like that in the plate, or the flasks should contain some determinate quantity; the former is the more recommendable. When these things are provided, the flask or ball *b* is exhausted over the air pump, and its weight is then accurately ascertained, even to the fraction of a grain. When this is

done, a certain quantity of the gas, the specific gravity of which is to be determined, is admitted into the globe from the graduated glass *a*, and we thus know exactly the quantity which is admitted. This operation should be performed slowly and gradually; for if the cocks be rapidly turned, some water is apt to arise and vitiate the results; this too is prevented by inserting a piece of blotting paper in the mouth of one of the glasses. When the flask or ball is filled, it is again weighed; and knowing the weight of the exhausted vessel, knowing also the quantity of gas admitted, we find by the second weighing the exact weight of this quantity. Suppose we make an experiment of this kind on common air, we shall find that 100 cubic inches weighs 30 2-10 grains.* As it is a principle that all gaseous bodies are equally dilatable by heat, and equally affected by degrees of pressure, we may either measure the specific gravity of gases, and take into account all the barometrical and thermometrical changes which go on during the experiment; or performing the operation in as short a space of time as possible,

* As we observe that there is some difference between what we understood Mr. Brande's statements to be, and the printed statements of some other specific gravities, we shall not repeat what we think he said, for fear of committing a mistake.

we may neglect them all, and still have the exact relative specific gravities of one gas to another, which is all we ever obtain. Mr. Brande recommended the latter, as the former compels us to have recourse to several observations, and to complex calculations. He also recommends that the gases to be experimented on should be collected over water when not absorbed by it, when they thus get saturated with moisture, like the atmosphere, which makes the relative weights of the gases and the atmosphere more precise, for they are both equally affected by the same circumstances. In cases of difficulty it is better to repeat every part of the experiment several times, and take the mean of the results. When we have found the weight of any gas, its specific gravity as to air or as to hydrogen is known by a very simple rule. If, for example, 100 cubic inches of air weigh 30 2-10, and the same quantity of oxygen weighs 33 75-100, we say 30 2-10 : 33. 75-100 :: 1000 : 1175, specific gravity of oxygen.

The specific gravity of gases may also be determined by first weighing the flask full of common air, again weighing it when exhausted; and again when full of the gas, the specific gravity of which we desire to know; and as the loss between the first and second weighing is to the gain or loss at the third weighing, so is common air to the gas we are experimenting on. Thus, suppose by exhausting the flask, it loses 30 2-10, and that by admitting oxygen it gains 33 75-100, then 30 2-10 : 33 75-100 :: 1000 : 1175. Having learnt in this way the specific gravity of the gas, we have only to reverse the calculation to find the weight of 100 cubic inches of the gas—thus, 1000 : 1175 : : 30 2-10 : 33 75-100. We know that our assumption of 1000 for water is equal to 100 cubic inches, and therefore the specific gravity of any gas gives by this rule the weight of 100 cubic inches.

There are several methods of determining the composition of the atmosphere, and the instruments employed for this purpose, have been called eudiometers, from its having been supposed that they informed us of the relative healthiness or purity of the fluid. When it was first discovered that the atmosphere consisted of two distinct gases, one supporting flame and life, and the other instantly extinguishing both, it was immediately concluded that the relative healthiness of different places was owing to these gases being mixed there in different proportions. More extended observations have taught us the fallacy of this conclusion; and wherever atmospheric air has been examined, on sea or on shore, at the equator and at the poles, on the tops of mountains and in the lowest vallies, it has always been found to contain the exact same proportion of these two ingredients. We may ascertain the quantity of oxygen in the atmosphere, by mixing a portion of it with hydrogen gas, and firing it with the electric spark; the quantity of gas which disappears will, as one volume of oxygen combines with two of hydrogen, indicate the quantity of gas in the mixture. We may also ascertain the quantity of oxygen in a given portion of air, by inclosing with it a piece of phosphorus, and setting fire to the phosphorus by the heat of a spirit lamp, when the whole of the oxygen will be absorbed. By experiments of this kind it has been ascertained that the atmosphere is composed in the 100 parts—

	By bulk.	By weight.
Oxygen	20	22.3
Nitrogen	80	77.7

And it may be represented as containing two proportionals of nitrogen and one of oxygen, thus—

nitrogen 14	ox. 8
14	

The Professor concluded his lecture by mentioning that hygroscopes and hygrometers were instruments for measuring the quantity of moisture in the air, and the

variations in this quantity. Of all the instruments however invented for this purpose, only that of Mr. Daniell deserves the name of an hygrometer; and for an account of this instrument, the Professor referred to Mr. Daniell's book on Meteorology.

COMBUSTION.

To the Editor of the Chemist.

Sir,—It undoubtedly affords me great pleasure to find that your correspondent, Simon Pry, has obtained a little more "*light*" on the subject of combustion, although rather more "*heat*" may have been evolved than I had anticipated. Instead of giving me credit for a good intention, at least, though I might have failed to convey the information he needed in a sufficiently intellible manner, he turns round upon me, with the charge of "exposing to ridicule so low a subject as *me*." By the way, Mr. Editor, has your Correspondent adopted a "new theory" in grammar as well as in chemistry? Under the present system, no boy, ten years of age, would escape a sound flogging were he to introduce such a sentence into his exercise.*

When I answered your Correspondent's former letter, I perceived that he still relied on the old theory of combustion, which I had already discarded, which was the reason why I said that he "had entangled himself with a theory;" &c. I did not, however, conclude with your Correspondent, that "under the old theory the question could not be answered." I considered that it would admit of no very difficult solution, which I determined to attempt. Unfortunately, however, it would appear that I have not been sufficiently clear in detail, so much so, indeed, as to have given rise to a slight misrepresentation on the part of your Correspondent, which, when pointed out, he will, I am sure, be the first to correct. But let us proceed a little more regularly.

That part of my letter which appears to have given most offence to your Correspondent, is the concluding passage. The expression, "combustion having to search for food among a heap of rubbish," appears to him so very unclassical, or, if you please, unchemical, that he can by no means conquer his aversion. I hope, however, to convince him that I am not quite so destitute of "*pryingness*" as he imagines; neither have I entirely sacrificed "*sense*" to "*sound*, and the pretty piece of poetry at the end." I confess my letter must have been strangely worded, if it has led Simon Pry into the difficulties in which he is plainly involved. He supposes that I made use of "a trope or figure," and, letting "go the sense for the sake of the sound," made use of the word "*combustion*," instead of "*combustible*." This proves more clearly than any thing he could say that he does not understand me. He may rest assured that, however destitute of "*pryingness*," I should never think of talking about a *combustible* "having to search for food."

But to the explanation he requires. And here, be it remembered, I speak according to the old theory, which both he and I have now abandoned. "Since," according to Simon Pry, "combustion is a union of the combustible with a determinate quantity of" its supporter, "oxygen," this gas may, I should think, without much reference to "a trope or figure," be styled "its food,"—that which nourishes or *supports* it. And as in the "mixed atmosphere," oxygen exists combined with nitrogen, in the proportions of 22 volumes of the former to 78 of the latter;† and as nitrogen, for the purposes of combustion, is useless, the word "*rubbish*" may not unaptly be applied. Its quantity, likewise, be-

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* Should S. P. require to be "taught what is right on this subject," I would beg leave to refer him to the twentieth rule of Syntax, and Mr. Murray's observations thereupon.

† Dr. Thomson says, 21 parts, by bulk, of oxygen, to 79 of azote.

ing nearly three-fourths greater than that of oxygen, it may be comparatively termed "a heap," among which combustion has to seek its support, the oxygen, scattered throughout. I think it will be apparent to your Correspondent and your readers, that in making use of the expression, "having to search for its food among a heap of rubbish," I have not had occasion to resort to a very "profound metaphor;" nor have I "let go the sense for the sake of the sound;" since it is the "combustion," not the "combustible," which is supported by the oxygen. After this, the assertion contained in a parenthesis, that it was the atmosphere I called rubbish, need not more particularly be alluded to. I cannot but hope the generality of your readers did not so widely misunderstand me as your Correspondent: as it is, he will not fail to remark that his witty parenthesis has every thing to recommend it but—truth.

We now come to the unfortunate "illustrative analogy," with which Simon Pry charges me with "taunting his ignorance." Nothing was ever farther from my thoughts. On the contrary, I put the case as to one who perfectly understood its merits,—much better, no doubt, than I make any pretensions to. I said, that "a person who inhales nitrous oxide experiences a quicker circulation of blood, and a greater flow of animal spirits, than he who breathes the 'mixed atmosphere.'" This I ascribed to the oxygen being separated from a part of its attendant nitrogen. Your Correspondent denies this conclusion; stating, that "*pure oxygen*, when breathed, has no such effect as is produced by the nitrous oxide." I make no doubt your Correspondent has not adopted this opinion on slight grounds; but until I am acquainted with those grounds, I cannot exactly coincide with him. In support of my opinion, I beg leave to offer him a few extracts from a well known work, Parkes's "Chemical Catechism," and I trust he will allow them the merit of being "ap quotations:"—

"Dr. Higgins having caused a young man to breathe *pure oxygen gas* for several minutes, *his pulse*, which was at 64, *soon rose to* 120 beats in a minute. Pure oxygen gas has been also used with success in cases of suspended animation."

"'If the proportion of oxygen and nitrogen were reversed in atmospheric air, the air taken in by respiration would be *more stimulant*, the *circulation* would become *accelerated*, and all the secretions would be increased; but the tone of the vessels thus stimulated to increased action, would be destroyed by over-excitement; and, if the supply from the stomach were not equal to the consumption, the body must inevitably waste and decay.'—(Dr. Lambe.)"

"Were it not for the large quantity of nitrogen in the atmosphere, the *blood would flow with too great rapidity* through the vessels, and all animals would have *too great spirits*."

Not to weary him with extracts, I think I have quoted sufficient to prove that, at least, I do not stand alone in my opinion, that oxygen does promote "a quicker circulation of blood, and a greater flow of animal spirits;" and that the greater its proportion in any combination of it with nitrogen, the more evidently will these effects be produced.

I have now, I believe, attended to those parts of his letter more immediately affecting myself. With respect to the explanation he gives of his sentiments, under the theory he has recently adopted, I have only to say he has expressed my own opinions on the same subject. The reason why I did not give that explanation in my first letter was, as I have before stated, that I considered his question might be answered without reference to any other than the old theory. Whether this has been done, it will be for your readers to determine.

I remain, Sir,

Your obedient Servant,

Jan. 20. N. R.

FLAME IS HOLLOW.

To prove that *flame is hollow*, says Mr. Gurney, and that the interior is filled with gaseous matter, at a low temperature; pour a little spirits of wine on a common plate, and inflame it; introduce burning phosphorus through the external film of the flame, and when so introduced it will be extinguished. Camphor, also, and a taper, become extinguished when introduced into the interior of flame. Inflammable substances, of any kind, will not burn within the interior of this film of ignited matter.

Draw a small wire across flame produced in the same manner by spirits of wine, or any other inflammable body, it will be seen to be *strongly ignited* at both sides where it intersects the film, but at no other point in the whole length; that part of the wire which passes through the interior will be *scarcely heated*, at all events, not to a visible red heat.

Drop carefully some spirits of wine on the surface of water, or within a small hoop or ring floating in a basin, set it on fire, and introduce your finger under the edge of the hoop, and up through the water into the interior of the flame, you will perceive no heat whatever, unless you reach sufficiently high to touch the film itself.

To prove that the interior of flame consists of *gaseous matter*, waiting, as it were, its turn to catch fire, introduce within it one end of a glass or other tube, a little inclined, the gaseous matter will escape through it, and may be inflamed at the upper end as it issues into the atmosphere.

NEW USE OF POTATOES.

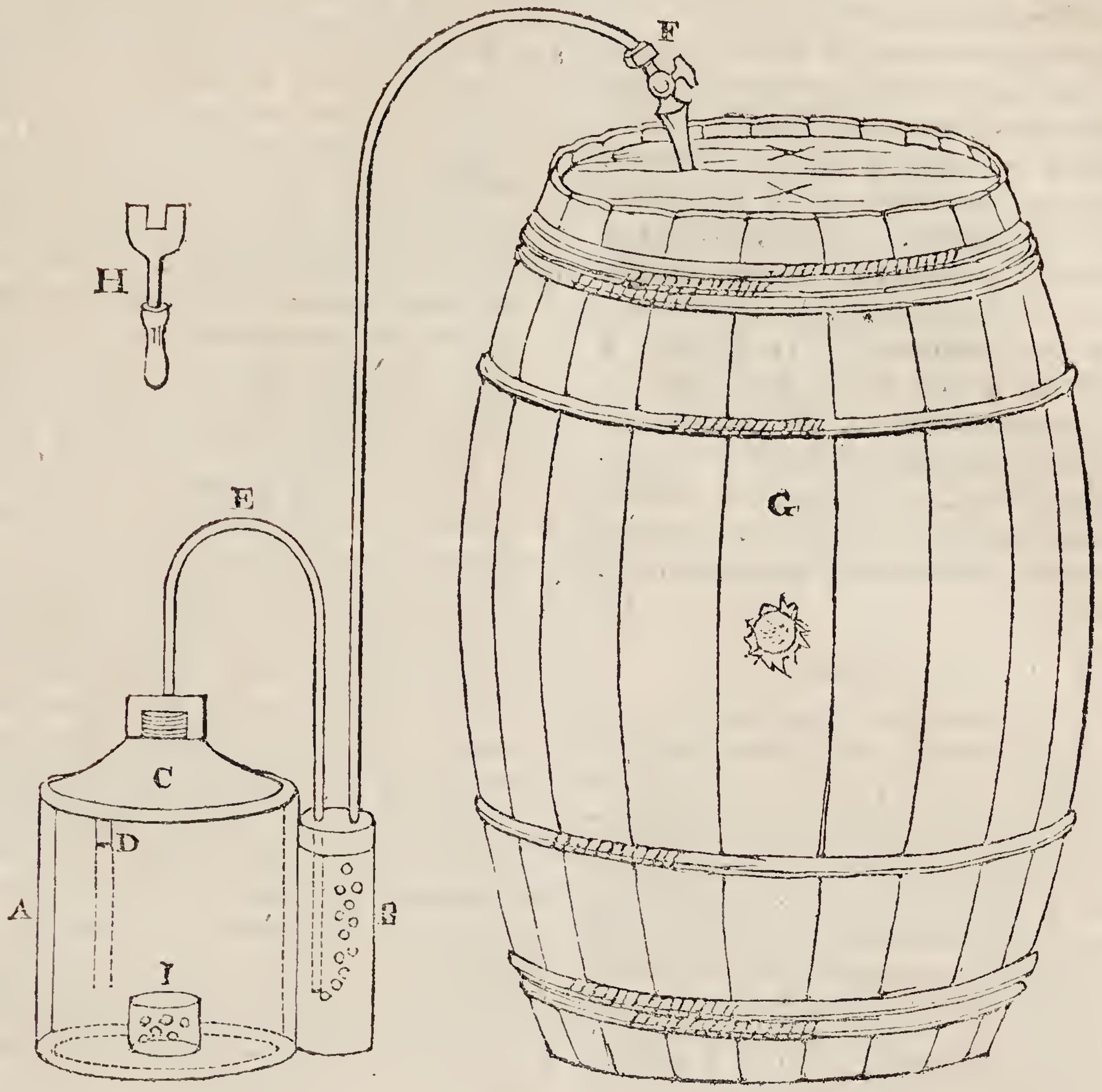
The inhabitants of several tropical countries find in the fruit of the palm tree and its trunk the materials of their food, drink, clothing, furniture, and of all the instruments they use. Verily it seems that we Europeans are to find in the potato what the South Sea islanders find in the palm-tree. It has long supplied us with food; drink of different kinds has been made from it, and we now have a man suggesting, in a foreign journal, how it may be advantageously used for a paint. Take, he says, a pound of potatoes, peel them, and boil them well, pound them while they are yet hot in three or four pounds of boiling water; then pass them through a hair searce; afterwards add to them two pounds of good chalk, very finely powdered, previously mixed with 4 lbs. of water, and stir them both together. The result will be a species of glue, or starch, capable of receiving every sort of colouring matter, even of powdered charcoal, of brick, or of lamp black, which may be employed as an economical means of painting door posts, walls, palings, and other parts of buildings exposed to the action of the air.—*Wochenblatt des Laudw. Vereins. in Baiern.*

TO PULVERIZE GLASS.

Lay a piece of glass between two metallic points, so that these two points touch the sides, not the flat surface of the glass directly opposite to each other, so that, in fact, the glass may form part of the electric circuit. Under these circumstances, if a strong electrical shock is transmitted through the metals, the glass will be shattered into powder.

TEST FOR CHALK AND ALUM IN FLOUR AND BREAD.

Add to the flour to be tried a little sulphuric acid; if chalk or whiting be present, an effervescence ensues, arising from the disengagement of the carbonic acid of the chalk. To make the experiment with bread, it must first of all have boiling water poured over it, and sulphuric acid then added. If no effervescence ensues there is no chalk or whiting, either in the flour or bread. To detect alum, the bread must be soaked in water, and to the water a slight solution of muriate of lime must be added, when, if alum be present, the liquid will become milky, owing to the sulphuric acid of the alum uniting with the lime of the muriate used as a test.



TO PRESERVE BEER FROM BECOMING SOUR.

The following description, and the plate, are taken from the Mechanics' Magazine. The invention belongs to Mr. Joyce, who sent the account to the Editor of that work.

It is a well-known fact, although not always the more agreeable on that account, that cyder, perry, and even ale and porter, leaving out of the question that undefinable compound, London small or table beer, very soon become, if in cask and in tap, extremely flat and insipid; this state continuing until another change takes place, viz. the production of acidity, or transformation, partially or wholly, into vinegar.

To remedy this evil mechanical means have been resorted to, and patent cocks and vent-pegs introduced without number. These, however, only guard against the carelessness of servants, and are otherwise quite incompetent to the task, inasmuch as some body, either fluid or aëriform, must be admitted above to allow of the liquor escaping from the cock below. When, however, the fluid has become hard, or, in another word, sour, chemical means are called in; and if they cannot bring back the spirituous out of the acetous stage, they can at any rate prevent the injurious action consequent upon the internal reception of a fluid in such a state. To this effect, a few grains of the finely powdered bicarbonate of soda are generally added to a tumbler full of beer; but should any liquor thus carbonated be left for a moment, it is worse in flavour than before; and as the degree of acidity varies every day, so, consequently, an increased dose of

the soda is necessary, and to hit the point of saturation exactly is one of no small difficulty.

It is unnecessary to occupy your pages with the many objections to which this process is liable; those who use it would, I make no doubt, rather be without it if the beer could be saved. To this effect I made the present machine, which in every respect fully answered my expectations. It is simply a generator of carbonic acid gas, a body well known for its quality of resisting putrefaction for a considerable length of time, and which, if absorbed by any liquid, renders it brisker and more palatable than before.

DESCRIPTION.

A is a cylindrical stoneware vessel, capable of holding from three quarts to one gallon, or more if necessary; the size of the instrument varying, of course, with that of the cask in tap, and perfectly open at the top, with the exception of a rim, in which two notches are cut; attached on the one side is a small reservoir, B, for containing a little water, and which may be thought necessary to purify the gas as it is generated; this vessel, which need not be of a greater capacity than a half-pint measure, has no direct communication with the other part of this apparatus. C is another vessel, of a bell shape, quite open at the bottom, and furnished with a dome top, mounted with cap and screw, to which the pipe E is affixed. D is one of two small projections, which serve to keep the bell down and steady in its place. F is an union joint, which connects the long pipe to the screw, which is first made fast in the vent-hole of the cask, by turning with the key H. I is a bason or vessel perforated at the bottom, and which is used to hold the marble or chalk for generating the gas. To set this apparatus at work, first make the screw tight into the cask G, which may either rest on its side, or be placed on one end, as in the drawing; the latter I consider preferable; the capillary attraction between the fluid and the fibres of the wood not being in this way impeded, and a small quantity of water poured on the top or head of the cask being sufficient to keep all tight. Secondly, remove the bell from the outer case, and put such a quantity of common marble, carbonate of lime, broken into fragments, about the size of a walnut, into the dish I, as will two-thirds fill it; put the bell in its proper position, as represented; make the flexible tubing, E, fast; half fill the reservoir, B, with water, by one of the three apertures or necks with which it is furnished; take care to fit the cork in again quite tight, and connect the long pipe by means of the union joint of the screw F; having done so, which will occupy but a very few minutes, pour on the top of the bell C, a quantity of dilute muriatic or sulphuric acid, and which may be composed of one part acid to eight of water, until the liquor just makes it appearance at the top of the outer vessel; take out the cork in the reservoir B for two or three minutes, to suffer the common air contained in the bell to escape; fasten it again quite tight, and the process is finished. It will now appear evident to any one, that as soon as a certain quantity of carbonic acid gas is generated in the bell by the action of the acid on the marble, the acid liquor will be driven by the pressure inside into the outer vessel, a sufficient space for which has been allowed between the two; there it will remain until the stop-cock at F, to which the thumb and finger are applied, instead of the common vent-peg, is turned, when a quantity of fixed air will rush into the cock to supply the place of the liquor withdrawn. Should this stop-cock be left turned on, an absorption of a portion of the gas will be the only consequence; and this, as before stated, will only tend to increase the briskness of the liquor, although, in general, it will be better to turn it off. The diluted acid having now got to its level, supposing a quantity of beer, or whatever it may be, to have been withdrawn, equal to the size of half the bell, it is actively at work on the marble within, and would thus continue until the whole of this substance, or the acid were expended, or, as will here be the case, until the pressure produced again forces it between the two vessels. When this gas is used, another portion is made, and so on, until either the cask is emptied of its contents, or the acid neutralized. Should the latter be the case, the addition of a little more strong acid will produce an extrication of a fresh portion of the gas, provided there still remains some undecomposed carbonate of lime; but if this is not the case, the bell must be raised out of the larger vessel, and the basin, I, replenished as before.

As I now fear that I have obtruded too much upon your time and space, I shall only add, that the expense of the gas, as generated by this machine, will not, for a butt, be more than equal to half a gallon of the same liquid of ale, and that it will preserve the whole to any moderate length of time from the injury which must always

attend the admission of common air; and that even the expense of the machine itself will not be proportionate to the loss occasioned in the common way.

HUNT'S MATCHLESS MATCHED.

We have been, on more than one occasion, requested by some of our correspondents, to tell them how to make Blacking; and only in our last Number a valued correspondent gave, in reply to such an inquiry, a useful receipt. We have now another to present them, from the very highest authority, and of the very highest reputation. Though we have no doubt that the French, who have always preceded us in fashions and modes of dress, were the first to introduce the practice of blacking shoes; yet they have not hitherto attained the same perfection as we have in the art of manufacturing Warren's Japan, Day and Martin's Unrivalled, Larnder's Incomparable, and Hunt's Matchless. Till a very late period, the only mode known of blacking shoes in Paris was to paint them. Numberless *artists decroteurs* were encountered in every part of Paris, who first scraped off the rough dirt with a knife, and then daubed over the remainder with a paint-brush and a black mixture that shone just as long as it was wet. Since the peace, however, they have imported both our blacking and our mode of applying it, and nobody now in Paris, except an old fashioned waggoner, perhaps, who has not yet laid aside his large pigtail and his powdered hair, ever has his shoes polished but in the English mode, and with English blacking. *Cirage Anglais* is the passport to employment, which is called out by every shoeblack boy desirous of custom. Anxious, it would seem, for the honour of France, and probably ambitious of depriving the *eternal* enemies of his country, as the French sometimes call the English, of that most valuable branch of commerce—supplying Paris with blacking, M. Braconnot lately undertook a chemical examination of several specimens of English blacking, supplied him by an intelligent shoemaker. The results of his examination are consigned to the pages of no less distinguished a Journal than the *Annales de Chimie et de Physique* for Nov. 1824, which being one of the first scientific periodicals of the age, conducted by MM. Gay Lussac and Arago; and M. Braconnot himself being a very distinguished chemist, we are sure we shall not discredit our pages by translating his remarks, though on the subject of *blacking*. He rightly observes, at the commencement, "that the examination of the most common things may sometimes offer useful results;" and for our parts, so highly do we prize these common things, we cannot help congratulating the French chemist for descending from the *uncommon* abstractions of science to the level of every-day life. "I found," he says, "that all these different blackings contained, though in different proportions, ivory black, phosphoric acid, sulphuric acid, a fixed oil, a volatile oil, and an extract like that from malted barley. It was easy, therefore, for me to imitate them, which I did; but I obtained a better result by simplifying the process. The materials I used were these—

	lbs.	oz.	dr.
Plaster of Paris (sulphate of lime) sifted through silk; one kilogramme, equal to . .	2	3	5
Lamp-black, two hectogrammes and a half	0	7	0
Malt, five hectogrammes	1	1	8
Olive oil, fifty grammes, by weight	1	2	0

The malt is macerated in boiling water till every thing soluble is taken up; the plaster of Paris and the lamp-black are mixed with this solution, and it is then evaporated to the consistence of paste, and the oil is afterwards mixed with it. A few drops of oil of lavender or of citron may be added, to give it a pleasant odour; and if plaster of Paris cannot be conveniently obtained, an equal quantity of com-

mon potters' earth may be substituted in its place."

"This blacking," M. Braconnot concludes, "is undoubtedly the cheapest and the best; it spreads very evenly, dries speedily, and shines brilliantly with very little brushing, and does not burn or destroy the leather."

We hope some of our readers will put this receipt to the test of experiment, and let us know the result.

ENGLISH FIRE-SIDES.

We have frequently in the course of our labours mentioned the imperfect and wasteful mode by which our houses are warmed. Let the reader just recollect that the heat of the invisible flame of a common spirit lamp is quite sufficient to make platinum red hot, and also recollect that not only the invisible but the visible flame of our fires are forced up the chimney by a perpetually renewed current of cold air, and he will see at once how much we waste our fuel, and how badly we apply the heat derived from it. At the same time, though our practice is very imperfect, it may be doubted if the comfort and well-being of the great mass of the people in this climate does not depend as much on the warmth of their houses as on food and clothing. It is, for example, remarked, that the labouring classes in the coal districts of our country, in which fuel is cheap and plentiful, are straighter, better grown, and more fleshy than the labouring classes in those parts of the country, such as Kent, Sussex, Essex, Hampshire, and Berkshire, where fuel is scarce. This is attributed, and probably with justice, to the insufficiency of warmth and dryness under which they suffer, generation after generation. Any body who has seen them cowering over some half-burned embers, not giving heat enough to dry their raiment, which has been wetted in the labours of the day, and must be resumed on the morrow in its damp and murky state, must be sensible how much of their animal comfort depends on heat, and how wretchedly deficient we are in the means of thoroughly warming every part of our habitations. They manage these things, we must say, better, both in Germany and Russia; and there every peasant's hut, though its cleanliness cannot be commended, preserves throughout their long and dreary winters a uniform and comfortable temperature. There is yet, therefore, great room for invention to supply the lower and middling classes of our country with a cheap, convenient, and economical mode of warming their apartments. We know of no invention for this purpose which deserves the least praise. Mr. Boyce, who has lately published a work on, and who has invented a stove for, heating apartments, which, however, he does not describe, is of the same opinion on this point as ourselves.

"That the present mode of obtaining warmth," he says, "is defective in an eminent degree, every one, however unwilling to confess himself in error, must be innately conscious. A more bungling and inefficient process was, perhaps, never devised, than that by which it is attempted to raise the temperature of an apartment by means of an open fire in a grate and chimney of the modern construction; nine-tenths of the heat produced by the one, being, from the very nature of things, immediately carried off through the channel of the other; and the remaining tenth, slowly communicated to the air of the apartment, is just sufficient to convert every aperture and crevice into a trap for colds, fevers, rheumatism, and all the disorders arising from checked perspiration. Talk of the comforts of an English fire, indeed! it is a pitiful mockery: there is not a nation on earth, between this latitude and the Pole, (for with the inhabitants of southern Europe, of course we can draw no parallel,) but knows more of the comforts of a fire than England does. Germany and Russia, our

two great competitors, have long been possessed of superior winter comforts to ourselves; and even the poor diminutive beings within the Arctic Circle, contrive, by means of a few heated stones, and a half-buried hut, to procure more of the real enjoyment of warmth, than an Englishman, with all his boasted dexterity in art, has ever been able to command. In order to put this part of the subject in its proper light, it is only necessary just to trace, by way of illustration, the history of *English fire-side pleasures*, through the period of a December day," p. 11, 12.

"The first sensation of which you are conscious, on awaking, is that it is 'a bitter cold morning;' and, with an anxious look at the frosted panes, and a glance at the empty grate, you flatter yourself that, by dressing very expeditiously indeed, you may yet indulge for another half hour, in the enjoyment of your comfortable dormitory; but time flies quickly with the happy! and when you are really risen, you find that a full hour of the day is passed, which no after-exertion can absolutely recover. At length, quite dressed, and half frozen, you descend to the breakfast parlour, and, with all the impatience of long repressed desire, rush, shivering and open-handed, to the bright, sparkling, happy-looking fire-side. The first greetings of this loved object are not, however, quite so kind as might be wished; for in a few moments you begin to feel the effects of the sudden transition, in a tingling sensation about the extremities of your swelling fingers, till, as if by a torpedo shock, you find your power over them gone; while the exquisite pain, conquering all ideas of dignity, sends you dangling them, and dancing in agony round the room." p. 13.

We shall return to this subject, as one of very great importance to the comfort of the people.

TO PROCURE ATROPIA.

(*In answer to a Correspondent.*)

M. Brandes boiled two pounds of the dried leaves of *atropa belladonna* in a sufficient quantity of water, pressed out the decoction, and again boiled the leaves in water. The decoctions were then mixed, and sulphuric acid was added, to throw down the albumen and other similar bodies. The solution then passes easily through the filter. He afterwards supersaturated the decoction by potassa, and obtained a precipitate which, after being washed with water, and dried, weighed 89 grains. It consisted of small crystals, and on being dissolved in acid, and afterwards precipitated by alkalies, was atropia in a state of purity. M. Runge, however, has lately ascertained that the narcotic principle of belladonna is destroyed, or so changed by alkaline solutions, as to lose its distinguishing property of causing dilatation of the pupil of the eye. Lime water even effects this. Magnesia, however, exerts no such action, and should therefore be used instead of the alkalies in the process above described. It should be used as thrown down from sulphate of magnesia by potash, added in such quantities as not to decompose the whole of the salt. The mixture should be added to the aqueous infusion of belladonna, and the whole evaporated by a brisk fire to dryness; the residue, which is readily dried and pulverized, is to be treated with highly rectified boiling alcohol. The clear yellow solution is to be evaporated spontaneously, and a crystalline mass is obtained, which slightly blues reddened litmus paper, dissolves in water, and produces extreme dilatation of the pupil. The salts formed by it with sulphuric, muriatic, and nitric acids, also produce the same effect on the eye.

THE ARCHIMEDIAN MIRROR,

A GENERATOR OF STEAM.

When a thermometer is exposed to the solar ray reflected from a

plane glass mirror, the mercury rises *two-thirds* of the height it would attain if exposed to the sun's direct ray. Three mirrors are equal to *a two-suns' power*. When the sun or his reflected image acts upon a thermometer, it becomes stationary after some time, because, though the source of heat is constant, all further increase is impeded by radiation, contact, and the agitation of the air. The thermometer or other object to be heated, should therefore be inclosed within a cover or screen of planished tin, or other material, furnished with a metallic surface; and the solar ray should be transmitted through a pane of glass, which will remain uninjured by the passage of heat, if chosen perfectly transparent and thin. Over this cover, if a second and a third concentric cover be placed at the distance of half an inch, the *accumulation* of heat may be so augmented that *a solar ray will boil water*.

In the Encyclopedia it is stated, that "the action of a vertical sun through a thin capsule of glass might heat up a dark horizontal surface, 113° by Fahrenheit's scale." This effect, though *far* inferior to what we have repeatedly obtained, we shall however adopt, as a moderate element of calculation; and shall find that, at the temperature of 62°, 2 mirrors boil water, 8 melt lead, and the *Solar Reflector*, composed of 99 six inch *specula*, being *a sixty-six suns' power*, will communicate to a surface of a quarter foot 7458 degrees of heat, or 466° over an area of 4 feet. Twenty such reflectors, that might be constructed for one hundred pounds, afford nearly 150,000 degrees of heat, *a power far superior to any ever before at the disposal of man*.

The means we have devised for preventing the *dispersion* of heat, will preserve it, when accumulated, several days or weeks, enabling us to operate by night as well as by day.

The *Solar Reflector* may be employed as a locomotive power over iron rail-roads, in navigation, in ploughing, harrowing, and other agricultural labours; in working mines, heating public and private buildings, &c. &c. without smoke or noxious effluvia. Its burning energy at great distances having been already experimented by others, I shall not dwell upon, but conclude by observing, that a *Patent Reflector* will be found an equally useful auxiliary to the *mechanic* in his workshop as to the *chemist* in his laboratory.

W. Corbet.

23, *Dover Street*,
Jan. 25, 1825.

ELECTRICITY IN SILK.

Symmer was the first person who observed that his silk stockings displayed marks of electricity. He wore generally two pair of silk stockings, one white and the other black. When he drew them off both together, he remarked no signs of electricity; but when he drew the black off from the white, he heard a rustling noise, and in the dark, saw sparks between both stockings. To make these electrical phenomena very conspicuous, it was only necessary to rub his legs a little with his hands before pulling off his stockings. When the stockings were separated and held at a distance from one another, the white were found to be positive and the black negative, to a great degree. At the same time, they both preserved the form of the leg, as if they had been blown into. If the two white or the two black stockings were held in the same hand, they repelled each other. If one of the black and one of the white were held in the same hand, they attracted each other. As they approached each other, the fulness before remarked in them gradually disappeared, and they attracted other objects with less, and each other with more power. When they came in contact they fell flat together. On being separated, the electrical phenomena again showed themselves, and apparently undiminished. All these appearances continued for a considerable time.

MERCURY IN URINE.

Dr. Cantu has lately examined the urine of persons who had used a considerable quantity of mercury by means of friction. From 60 lbs. of the fluid, he obtained a large precipitate; but after it had been separated, the liquid gave no trace of mercury. The precipitate, mixed with powdered charcoal, was exposed to the action of a red heat in a glass retort, its mouth terminating in a receiver filled with water. At the end of the operation a powder was found on the bottom of the receiver, which, on being dried, gave globules of mercury by pressure. From the whole 60 lbs. about 20 grains was obtained.—*Mém. de Turin, vol. xxix. p.* 228.

QUERIES.

To make a good French polish, such as sold in the shops.

To make Eau de Cologn.

To make a glaze, such as is used for China, and the Cónta á Paris.

To make a polish for furniture that will take out stains, as well as give it a lustre.

To make the balls known by the name of Birmingham balls.

How to make a permanent ink for marking linen, without the necessity of the common process of first dabbing the article with the liquid *natron. præp.* &c.

Sir,—I should be glad to learn of any of your intelligent Correspondents, the cheapest and best mode of decomposing curd soap, so as not to injure the colour of the tallow, and, *if possible*, preserve the alkali also.

Yours,

Soap in a Difficulty.

CIRCULATION OF THE SAP IN PLANTS.

In The Chemist, No. 33, p. 323, we inserted, from a foreign journal, some observations of Dr. Schultz, of Berlin, on the circulation of sap. They were very curious, but unfortunately they turn out to be incorrect. The subject excited great interest on the Continent, and Dr. Schultz's experiments have been repeated by several persons. M. Dutrochet, in particular, has repeated all the experiments of Dr. Schultz; and though he has perceived the trembling of the sap mentioned by the Doctor, he was unable to perceive any progression of a fluid, or any ascending or descending currents. He attributes Dr. Schultz's mistake to having employed the solar ray in his microscopic observations, which had before been observed to give rise to deceptive appearances.

DICTIONARY OF CHEMISTRY.

Fluor. The name of a large species of minerals, of which there are three sub-species, viz. *compact*, *foliated*, and *earthy*; it forms the *gang*, as it is technically called, of the copper, tin, and lead veins which traverse granite and clay slate.

Fluoric Acid. An acid obtained from *fluor spar*, and which is supposed to consist, like muriatic acid, of hydrogen and a base; the latter has been called

Fluorine. The acid is remarkable for the energetic manner in which it corrodes glass.

Fluorides. The name given to the combinations of the supposed principal, fluorine, with other elements; and, according to some theories, the substance usually called *fluate of lime* is not, as this name implies, a compound of fluoric acid and lime, but is a fluoride of calcium, or a compound of fluorine and calcium.

Fluosilicates. See the next article.

Fluosilicic Acid. A substance obtained by exposing silica to the action of hydrofluoric acid. It is a colourless gas, with an acrid odour, and is supposed to be a compound of silicum and fluorine. This substance has been united with some bases, as, for example, with ammonia, and the compounds which have resulted from the union of this substance with bases have been called *fluosilicates.*

Flux. Any substance which promotes the fusion of another when exposed to heat, and is added to it for this purpose. Limestone and fusible spar are the fluxes used on the large scale; in the laboratory alkalies answer this purpose. Crude flux is a mixture of nitre and tartar. White flux is formed by projecting equal parts of nitre and tartar at a time into an ignited crucible. The nitric acid flies off with the tartaric acid; the potassa is left behind in a state of purity. In black flux the weight of the tartar is double that of the nitre, and a portion of the tartaric acid being decomposed, leaves behind a black coat, whence the name.

Formation signifies, in geology, an assemblage of different masses, which have some common character, and are so united among themselves, and so separated from other masses of rocks or strata, that the geologist considers them as having been formed or deposited by one and the same cause. In systems of geology numerous *formations* are described.

Formiates. Compounds of formic acid with bases.

Formic Acid. A peculiar acid, obtained by distillation from ants. It is denser than acetic acid, and consists of hydrogen, carbon, and oxygen.

Fracture, in mineralogy, is the form and aspect of a mineral when a piece has been broken off by a hammer. The different appearance of stones, when thus broken, is used to distinguish them.

Freezing. In its most general acceptation, the solidification of bodies by the loss of heat: in its more limited signification, it means merely the solidification of water from this cause.

Fossil Copal, *Highgate resin.* A pale, yellow-brown, muddy substance, found in the bed of blue clay at Highgate. It has a resinous appearance, and when heated, gives out a resinous odour, melts into a fluid, takes fire at a lighted candle, and before the blow-pipe is wholly consumed.

SPECIMEN OF THE UTILITY OF CHEMISTRY.

Chemical analysis has within a year or two brought to light a great number of vegetable principles on which the peculiar properties of several plants depend. Thus the narcotic effects of opium, and other similar substances, are owing to a principle which chemistry teaches us to extract from them all, called morphia. Thus, too, the valuable medicinal properties of all barks are owing to two substances which modern analysis has brought to light, *cinchona* and *quinina.* Two or three grains of these are as efficacious as a drachm of common bark in powder, and possess all the febrifuge qualities of the latter. In the bark, however, these substances are combined with a great proportion of woody and inert matter, which has always been found to act injuriously on the stomach, and diminish the utility of the medicine. By the discovery, therefore, of the principle on which its valuable properties depend, and by enabling us to separate it from them, and administer it in its most efficacious form, chemistry has conferred a most important benefit on mankind, and has contributed much to the healing art. Perhaps, reasoning from analogy, chemistry may hereafter discover the nutritious principle of all substances, and contribute, like great agricultural improvements, to the cheapness of subsistence.

TO CORRESPONDENTS.

"A Subscriber" in our next.

We have as yet had no opportunity of trying Mr. Brown's ink; but when we have done so, and find it good, we will recommend it.

Our other Correspondents will find their communications inserted, or their requests attended to.

*** Communications (post paid) to be addressed to the Editor at the Publishers'.

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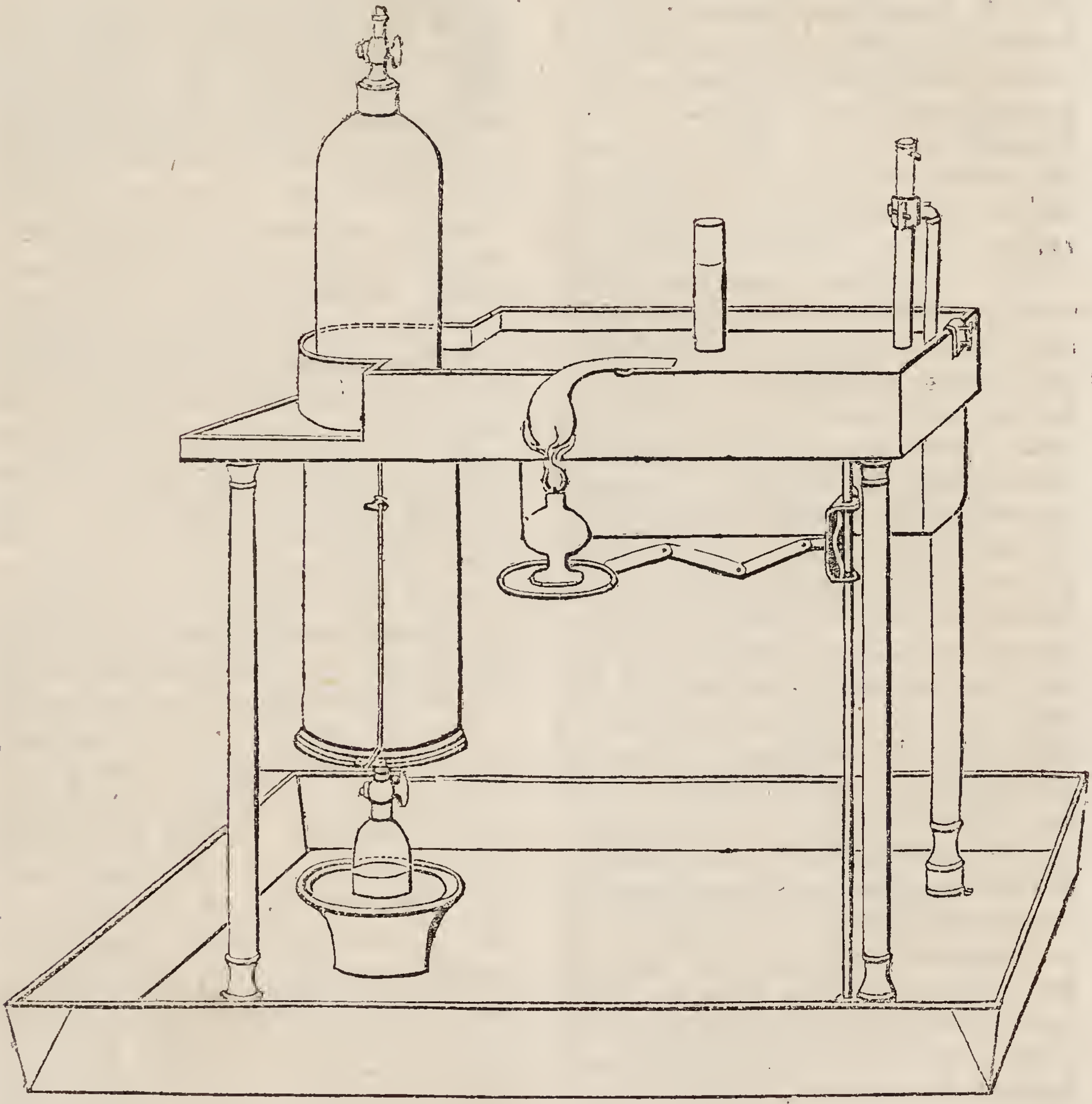

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NEWMAN'S MERCURIO PNEUMATIC APPARATUS.

The plate represents Mr. Newman's pneumatic apparatus for collecting gases over mercury. It has a very high character among the best chemists, but appears not to be generally known; for in a dictionary of chemical apparatus lately published, it is omitted. It consists of a trough of cast iron, supported by brass or iron legs, and having a small gasometer adapted to one end. It is placed in a japanned iron tray, to prevent the loss of mercury. The cut shows the moveable jointed stand belonging to it, with a lamp on it, a small retort, and a jar to collect the gas.

This apparatus requires about 60 or 70 pounds of mercury to fill it, and the trough has a cavity in the middle large enough to fill a jar ten inches long and two and a half wide. There is a shelf on each side, two inches in width, to support vessels containing gas, &c. Opposite to these indentations, on the edge of the trough, are three holes in one of the shelves, into which the beaks of retorts liberating gas may be inserted, or a sliding shelf with apertures may be fitted across the middle for the same purpose. The gasometer is at one end, sunk beneath the level of the trough, and contains about fifty cubic inches. A tube connected with the gasometer at the lower part is made to ascend, and passing up through the mercury, in a corner of the trough, at about an inch above it, bends down again, and terminates beneath its surface. If gas is contained in the gasometer, it may be transferred to air jars in the trough, by filling them with mercury; placing them over the end of this bent tube, and giving pressure to the gasometer, the air will pass from the gasometer along the tube into the jar. By the bend of the tube the mercury is prevented from passing into the lower part of the gasometer, while the gas is allowed a free passage. At the same time, there is a stop cock to cut off the communication between the trough and the receiver. There is also a detonating tube, attached to the apparatus by a clamp and screws, and may be fixed on any side of the trough.

LECTURES AT THE ROYAL INSTITUTION.

SULPHUR. SULPHUROUS AND SULPHURIC ACIDS.

Lecture 22. The substances hitherto mentioned, Mr. Brande said, generally existed in a gaseous form; but the next two of the electro-positive bodies, or bodies attracted to the negative electric pole, which are to be treated of, namely, sulphur and phosphorus, are solids. Sulphur is found abundantly native, and very generally in volcanic countries, though it is also found in countries where no volcanoes exist. It occurs crystallized, the form of its crystals being an acute octoëdron with a rhombic base. When pure, and the crystals are perfect, they exhibit the phenomena of double refraction in a high degree. Sulphur, when volatilized or inflamed, emits a very nauseous smell, but under ordinary circumstances it has no smell. When rubbed, however, we perceive its peculiar smell, and it becomes negatively electric. When heated to about 180, part of it volatilizes, and it fuses at about 225: at 350 it becomes viscid, and if it is poured into water in this state it preserves its viscidity a long time, and is employed in this state to take impressions from gems, casts, &c., which are known under the name of sulphurs. At 600 it rises in vapour, or is sublimed, and may be purified by this means. Native sulphur, which is in use for most purposes, comes to this country chiefly from Sicily; roll sulphur is chiefly obtained from the sulphurets of different metals. As the ore is roasted to obtain the metal, the sulphur sublimes, and is collected in chambers; it is afterwards purified, and cast into sticks or rolls. To obtain sulphuric acid, for the purposes of bleaching, and

to make gunpowder, native sulphur is preferred; roll sulphur is used for making matches.

There are two well-known and distinct compounds of sulphur and oxygen, the sulphurous and sulphuric acids; and there are also two other compounds which are not so distinct, hyposulphurous and hyposulphuric acids. All the compounds of sulphur and oxygen are acids; and we know no oxide of sulphur. They are represented as follows:—Hyposulphurous acid is a composed of one proportional sulphur and one of oxygen; therefore

ox.	sul.	
8	16	= 24 Hyposulphurous Acid

Sulphurous acid is a compound of one sulphur and two oxygen,

sul.	ox.	
16	8	
		= 40 Sulphurous Acid.
	8	

Hyposulphuric acid is a compound of one sulphur and two and a half oxygen, or two sulphur and five oxygen,

sul.	ox.		
16	8	72	
	8		
	8		= or Hyposulphuric Acid.
	8	36	
16	8		

Sulphuric acid is a compound of three oxygen and one sulphur, and

sul.	ox.	
16	8	
	8	= 40 Sulphuric Acid.
	8	

The hyposulphurous and hyposulphuric acids existing only in combination with some bases, will be hereafter again mentioned: at present only sulphurous and sulphuric acids are to be treated of. Sulphurous acid is obtained by burning sulphur in oxygen gas. It is a gaseous body absorbed by water, and must therefore be collected over mercury. In the combustion the oxygen combines with exactly its own weight of sulphur, or 100 cubic inches of oxygen gas, weighing 33.75 grains, unite with 33.75 grains of sulphur; and if we regard it as consisting of two proportionals oxygen and one sulphur, the sulphur being represented by 16, its equivalent number will be 32. One hundred cubic inches weigh 67.77 grains, and its specific gravity is to air as 2.2464, and to hydrogen as 32. Sulphurous acid may also be obtained by distilling sulphuric acid and mercury, the mercury taking one portion of the oxygen. Though this substance, in ordinary circumstances, exists as a gas, it may be liquefied at a pressure equal to $2\frac{1}{2}$ atmospheres; and it has also been ascertained that in distilling it over, if it be received in vessels kept very cool, it may be collected in the liquid form. It may then be put into glass vessels, and by closing them it may be preserved. The Professor had a quantity of this liquid sulphurous acid in two small glass tubes, and on breaking off the end of one the liquid assumed the gaseous form, and was collected over mercury. If it be mixed with water it falls to the bottom of the vessel in globules, and as it then evaporates it produces a sufficiency of cold to freeze the water. The Professor then broke the end off the second tube, and poured the acid into a small quantity of water, when a thin film of ice, he said, was formed, for we were too far off to see. This property of being condensed into liquids at certain pressures belongs to many of the gases, but sulphurous acid is more easily reduced to the liquid state than most of the others, and is thus more convenient for making experiments on, and ascertaining what

then occurs. The following table was then exhibited of the degree of pressure requisite to make the following gases assume the liquid form at the temperature of 50° :—

GASES.	Pressure in Atmospheres.
Sulphurous Acid	$2\frac{1}{2}$
Chlorine	$3\frac{1}{2}$
Cyanogen	4
Ammonia	$6\frac{1}{2}$
Sulphuretted Hydrogen	17
Muriatic Acid	40
Nitrous Oxide	52
Carbonic Acid	42
Carbonic Acid at 32°	36

Sulphurous acid gas extinguishes a taper, and is fatal to animal life; it first reddens blue vegetable infusions, and then destroys the colour. This property makes it useful in bleaching, and wove cottons, cotton stockings, and straw for making hats are all bleached by the vapour of burning sulphur. Water takes up rather more than thirty times its bulk of this gas, forming the common liquid sulphurous acid. The acid combines with bases, and produces a class of salts, called sulphites. It is not altered by a red heat, but if hydrogen be mixed with it, and it be then passed through a red hot tube, it is decomposed; water is formed, and sulphur is deposited. It is also decomposed by potassium. If we ignite a piece of this substance, and plunge it into sulphurous acid gas, it goes on burning, and shows us how cautious we ought to be in speaking of bodies supporting combustion or not. At high temperatures it also supports the combustion of several other bodies. In wine countries sulphurous acid is employed to check the fermentation of the wine: when it is at its best state, it is racked off and put into casks in which sulphur has been burned. It is probable that the sulphurous acid combines with, or decomposes some part of the fermenting matter, and thus arrests the process of fermentation. Sulphurous acid combines with ammonia, the only base yet mentioned, and forms sulphite of ammonia; but this is salt which is of no interest. I consists of equal volumes of the gases. It may, however, be remarked, that the sulphites, when exposed to the air, become sulphates.

Sulphuric acid is called also oil of vitriol, from having been formerly obtained from green vitriol; but it is now generally procured by burning eight parts of sulphur and one of nitre in proper chambers, the bottoms of which are covered with water. The specific gravity of the liquid sulphuric acid thus obtained is 1160 or 1170. It is afterwards concentrated by boiling, till it reaches the specific gravity of 1600; it then begins to act on the leaden vessel, and to absorb moisture from the air. To procure it still more concentrated, it is transferred to platinum or glass vessels, and is boiled till it attains a specific gravity of 1800. It is in this state a colourless fluid, extremely acrid and corrosive, and having an intense sour taste. [The process of forming sulphuric acid was imitated by burning a portion of sulphur and nitre under a glass bell.] It was long supposed that the use of the nitre was only to give out its oxygen to the sulphurous acid, and thus convert it into sulphuric acid; but MM. Clement and Desormes, and Sir H. Davy have explained the process in a different manner. The consequence of the combustion of sulphur and of nitre, is to produce sulphurous acid and nitric oxide, the latter forming, with the oxygen of the atmosphere, nitrous acid gas. When these two products, sulphurous acid and nitrous acid, are mixed perfectly dry, they do not act on each other; but water being present in small quantities, they unite and form a white solid, which is instantly decomposed on being mixed with water, the nitrous acid giving out the oxygen it had taken from the atmosphere, and reverting to the state of nitric oxide; the liberated oxygen combining with the sulphurous acid, and the water converting the former to sulphuric

acid. As the nitric oxide again assumes the gaseous state, and again comes into contact with the atmosphere, it absorbs more oxygen, is again converted into nitrous acid gas, which again parts with its oxygen to more sulphurous acid. Thus the process is continually renewed; and the real use of the small quantity of nitric oxide produced by the burning, is to serve as a carrier of oxygen to the sulphurous acid. Mr. Brande illustrated this theory by first converting nitric oxide into nitrous acid gas, by mixing it with oxygen; then mixing it with sulphurous acid, when a white solid was formed, and then admitting water, when nitrous oxide was set at liberty, and sulphuric acid formed.

Sulphuric acid, when pure, is colourless; that which is met with in commerce is generally coloured, owing to its being contaminated with some mineral substance. At the specific gravity of 1.8485 it contains about 81.54 parts in the hundred of dry acid. It requires nearly a red heat to make it boil, and at this temperature it may be distilled over, which is frequently done to obtain the acid pure. It must be put into a glass retort, and, to prevent it jerking and bursting the vessel, it is usual to put thin strips of platinum, or pieces of platinum wire, into the retort, which is found to answer this purpose. At 15° it freezes, contracting at the same time considerably in its dimensions. Exposed to the atmosphere, it absorbs moisture very rapidly, and increases in bulk as much as one fourth in twenty-four hours. In one year, one ounce exposed to the atmosphere became six ounces, having absorbed five. On mixing it with water, an elevation of temperature occurs, and the two substances decrease in bulk, or are condensed. This experiment the Professor said he had before shown the class, for another purpose. That sulphuric acid was a very fixed body was proved by pieces of zinc having been suspended over it for years without being in the least affected by it, while the acid, if the metal touch it, affects the zinc violently. The liquid sulphuric acid, which we are best acquainted with, is a compound of the dry acid and water. It has been stated that we can obtain the dry acid in a separate state; the consideration of this subject was, however, postponed till the next lecture.

WIRE GAUZE—SAFETY-LAMPS.

The following letter, *apropos* of the late explosions in coal-mines, has been addressed by Mr. Gurney to the editor of *The Times*:—

"Sir,—Observing in your paper of Thursday last, that another lamentable explosion has happened in a coal-mine at Middleton, in which Sir Humphry Davy's lamps were used; and as those dreadful accidents often occur under similar circumstances, the question of safety from the lamp itself becomes one of important doubt. I am therefore induced to state, through the medium of your journal, some facts respecting wire gauze, which, I believe, are not generally known; and I feel it a duty, while so many lives are sacrificed and endangered, to offer any facts connected with this interesting subject which may chance to have come to my knowledge, although they may be in opposition to high authority and popular opinion. The fact which I at present wish to communicate is, that wire gauze is a security in stopping the passage of flame to an explosive mixture of gases, when the mixture is quiescent or very little agitated; but when an explosive mixture is made to pass through wire gauze, with a moderate current, flame will pass and instantly explode it. Different mixtures require different degrees of pressure or velocities of currents to explode this wire gauze. Fire-damp explodes through the wire-gauze employed in the manufacture of Sir H. Davy's safety-lamps, under a pressure of seven grains to the square inch, which is equal to a current travelling at the rate of four miles per hour. Some of the

experiments on which this fact is founded are detailed in my published Lectures; they have since been extended, and varied with different proportions of atmospheric air and hydrogen, carburetted hydrogen, and sulphuretted hydrogen, assisted by several scientific friends, to all of whom the above fact seems evident.

"I am, Sir,

"Your obedient servant,

"*Argyle-street, Jan. 22.*" GOLD. GURNEY.

The experiments on this subject, in Mr. Gurney's book, are these: After stating that he believes so high a temperature as is usually said to be is not necessary for the inflammation of hydrogen gas, he goes on to observe—

"All gaseous bodies are elastic, and their particles move with the greatest facility amongst themselves: therefore, when a heated body (say a bar of red-hot iron) is plunged into it, it appears to me a necessary consequence, that the particles in immediate contact with the heating body become lighter by their comparative increase of temperature, and therefore pass suddenly away into a colder medium, before their temperature is risen to that heat necessary for their ignition: the particles which thus pass away from the sphere of heating action are instantly succeeded by another set of particles at a lower temperature, which pass away in their turn, from the same cause; and thus there is a perpetual interchange of temperatures, without the adequate one ever being attained. In the above view, we are supposing the heating body to be at a *red heat* only, such as a mass of heated iron; but if a body at a *white heat* be placed in contact with the inflammable matter in question, the particles of this latter receive the required temperature necessary for their inflammation *suddenly and at once*, before they have time (if I may so express myself) to make their escape.

"It is obvious, if my reasoning is correct, that the whole volume of gas under experiment must be heated to a certain temperature, or a portion of it suddenly heated to this particular temperature, before it will inflame. Now this particular point of temperature cannot be ascertained by the above method of experiment, nor do the other methods of experiment hitherto adopted appear to me to be more conclusive or satisfactory; at least those that I am acquainted with.

"If, for instance, we heat a portion of hydrogen gas in a porcelain or other tube, say to a temperature of 600°, and, in order that it may inflame, admit a portion of atmospheric air to it, it is evident that the quantity of atmospheric air necessary for the support of its combustion at common temperature, say 60° or 70°, must instantly rob the hydrogen of a considerable portion of its acquired temperature, and thus sink the whole to perhaps about 200° or 300°.

"Again, if we mix the supporter, oxygen, and the combustible body, hydrogen, together, in the proper proportions for combustion, and heat them as before in a tube, they will combine and form water without inflammation, and at a comparative low temperature.

"The usual methods, then, of endeavouring to ascertain this question being unsatisfactory, and the question itself being one of considerable importance, I lately instituted a series of experiments, for the purpose of endeavouring to throw some light upon it; some of which I will now detail, leaving it to you to draw the true conclusions resulting from them.

"To obviate as much as possible the disadvantages alluded to in the first method of experiment, namely, that of plunging into, or bringing in contact with gaseous bodies, a heated substance, I passed hydrogen gas through melted metal of known temperature, in very small bubbles; the column of the metal through which the gas passed up being fourteen or fifteen inches in height, I conceived that by this means I should give the gas time in its ascent, to gain the exact tem-

perature of the melted metal. This succeeded in part; and I found that the gas, on arriving at the surface of the metal, inflamed at a much lower temperature than that generally stated, and which somewhat confirmed the truth of my previous reasoning: I found, that the smaller the bubbles of gas were, the more easily they would inflame. This, however, was not a conclusive experiment, because, in the first place, aeriform bodies are such bad conductors, that it is more than probable the whole globule of gas was not heated thoroughly; and, in the second place, the atmospheric air on the surface was not of the same temperature with the metal. My next attempt was to pass a current of atmospheric air, heated to the temperature of the metal, over its surface, so as to meet the bubbles of hydrogen as they rose, and thus bring both together at the same temperature.

"I could not well manage this experiment, or could I correctly measure the temperature of the atmospheric air which was thus heated and forced on the surface, because it mixed in its passage with a portion of cool air, and thus became reduced, yet, from the imperfect results which I obtained, I was convinced of the comparatively low temperature at which this gas will inflame."

Mr. Gurney gives some further experiments on this subject, illustrated by a drawing, which we shall present to our readers next Number.

SPIRIT AND WATER.

It is well known, that when alcohol, or common brandy or whisky, and water are mixed together, the density of the mixture is greater and the volume less than the mean density and volume of both separately. This may be easily shown:—Take a glass tube, closed at one end, and blown at the other into two bulbs, communicating with each other by a narrow neck, the end one having an opening and being provided with a stopper. Into the opening pour as much water as will fill the tube and the lower bulb, holding the tube with the bulbs uppermost; now fill the upper bulb with alcohol, and when quite full put in the stopper and invert the tube. The two liquids, owing to the specific gravity of the water being greater than that of the spirit, immediately combine; and after a time, it will be found they have diminished in bulk, so that the tube will not be full. This change, however, is not complete for many hours; and probably a whole day will elapse before the contraction and combination are perfect.

This fact is of considerable importance in many respects. When the two liquids, for example, are mixed in the ordinary method, they will at first fill a gallon measure, and at the end of a day may not fill it by as much as half a pint. It is also well known to medical men, that the habitual use of wine, though it may probably contain as much alcohol as strong grog, is not so injurious to the constitution as the spirit and water. This is accounted for by the imperfect manner in which the two are blended, as in the latter case, when recently mixed. It is of great use, therefore, to mix spirits and water a considerable time before drinking the mixture. This fact is, we believe, well known to *cold* punch drinkers, who always make it some hours, and even days, before they consume it.

BLACKING.

To the Editor of The Chemist.

Mr. Editor,—In a late Number are two receipts for blacking, but you do not tell us how the ingredients are to be mixed. In all the blacking used at the present day, there is much too large a proportion of acid.

Many years ago I was in possession of a receipt somewhat similar to the first of yours, in p. 287, but in mine milk was used instead of vinegar. I have forgotten the exact proportions, and shall be obliged to any of your Correspondents who can supply this deficiency,

as I think it was the best blacking I ever used.

As far as I recollect, the blacking I allude to was made as follows:—

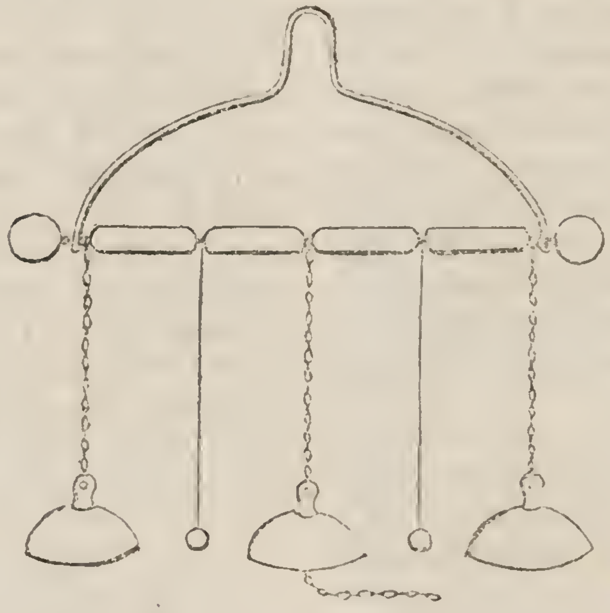
Certain proportions of sweet oil and sulphuric acid were cautiously mixed together, and stood 24 hours, by which time the oil had become black (carbonised); the treacle was added to the milk when boiling, so as to form whey, which was strained off, and mixed with the other ingredients instead of vinegar. Perhaps, if three pints of milk were taken instead of your Correspondent's three pints of vinegar, and his proportions of the other ingredients continued, a good blacking might be formed, which would not injure the leather.

Yours,

R. J.

ETHEREAL FIRE.

Ether is sometimes employed to make a species of artificial fireworks, in consequence of its inflammability, which, when it is mixed with atmospheric air, is very great. A prodigious body of flame may be produced, by pouring a small quantity of alcohol into nitric acid; in a short time a considerable action ensues, and ether is evolved. It may be set on fire as it issues from the flask or bottle, giving a prodigious flame, till at length a sort of detonation takes place in the bottle, not sufficient to break it, however, but to scatter the liquid abroad, and the flame goes out. It is hardly necessary, we suppose, to caution the reader, if he makes this experiment, to remove from the bottle after he has set fire to the issuing stream of gas.



AN ELECTRICAL PEAL.

We have already shown our readers two or three modes of ringing bells by electricity. Here is another; and if the bells be of different sizes and properly arranged, the lover of such music may have *bob majors*, *double peals*, and all the other *changes*, which so much delight our village musicians. It is necessary merely to have such an apparatus as is represented in the plate; but this consists of only three bells, and more may be used, and of different sizes, if the seeker after electrical harmony please. The apparatus must be hung on the prime conductor of an electrical machine; and on its being turned, the clappers will vibrate from bell to bell, giving very pleasing sounds.

QUERIES.

Is there any other fluid which will dissolve gum Senegal or gum Arabic more readily or quicker than water?

To the Editor of The Chemist.

SIR,—This morning, between seven and eight, in the neighbourhood of Islington, we were greatly surprised at every thing appearing of a reddish-purple hue: the effect was similar to that produced by looking at objects through stained glass, or by a great fire. If any of your scientific readers will favour me with the solution of this phenomenon, they will oblige,

Yours, &c.

Jan. 26. A SUBSCRIBER.

SIR,—I shall feel much obliged, if any of your Correspondents will inform me of a method (if any such there be) of decomposing muriate of soda, so as to disengage the alkali by the first decomposition.

I am desirous of learning, whether there are any *advantageous* means of accomplishing it, whereby the soda may be obtained at a cheaper rate than it usually is from barilla, &c. Soliciting an early insertion, I remain, Sir,

Yours, obediently,

Jan. 27. W. C.

What is the difference between white or flint glass and green or bottle glass, in its use for constructing electrical cylinders? And what is the smallest size of a glass cylinder, that can be used with advantage in the demonstration of the principles of electricity?

METHOD OF DISTILLING AT CHATRA, IN INDIA.

To the Editor of The Chemist.

SIR,—You will perhaps think the following little account of a mode of distillation in use in India, by Mr. Keir, worthy of insertion in your miscellany. I send it with the hope you may find it so, and am, Sir,

Your obedient servant,

A TRAVELLER.

The body of the still they use is a common, large, unglazed earthen water jar, nearly globular, of about twenty-five inches diameter at the widest part of it, and twenty-two inches deep to the neck, which neck rises two inches more, and is eleven inches wide in the opening. Such at least was the size of the one I measured, which they filled about a half with fomented Mâhwah flowers, that swam in the liquor to be distilled.

The jar they placed in a furnace, not the most artificial, though seemingly not ill adapted to give a great heat with but very little fuel. This they made by digging a round hole in the ground, about twenty inches wide, and full three feet deep; cutting an opening in the front, sloping down to the bottom on the sides perpendicular, of about nine inches wide and fifteen long, reckoning from the circle where the jar was to come, to serve to throw in the wood at, and for a passage to the air. On the side, too, they cut another small opening, of about four inches by three; the jar, when placed, forming one side of it, to serve as a chimney for the smoke to go out at. The bottom of the earth was rounded up like a cup. Having then placed the jar in this, as far as it would go down, they covered it round with clay, except at the two openings, till within about a fifth of its height, when their furnace was complete.

In this way I reckon there was a full third of the surface of the body of the still, or jar, exposed to the flame, when the fire came to be lighted; and its bottom not reaching to within two feet of where the fuel was, left a capacious hollow between them, whence the wood was short and dry when lighted, being mostly converted into flame, and circulating on so great a surface of the still, gave a much stronger heat than could else have been produced from so very little fuel; a consideration well worth the attention of a manufacturer, in our country more especially, where firing is so dear.

There, indeed, and particularly as coal is used, it would be better, no doubt, to have a grate, and that the air should enter from below. As to the benefit resulting from the body of the still being of earthen ware, I am not quite so clear in it. Yet as lighter substances are well known to transmit heat more gradually and slowly than the more solid, such as metals, may not earthen vessels, on this account, be less apt to burn their contents, so as to communicate an empyreumatic taste and smell to the liquor that is distilled, so often and so justly complained of with us? At any rate, in this country, where pots are made so cheap, I should think them greatly preferable, as at least much less expensive than those which the gentlemen engaged in this manufacture most commonly employ; though of this they are best able to judge.

Having thus made their furnace, and placed the body of the still in it, as above described, they add to this, luted on with moistened clay, to its neck, at the opening, what they here call an *adkur;* forming with it at once a cover for the body of the still, with a suitable perforation in it to let the vapour rise through, and the under part of the alembic. The adkur was made with two earthen pans, having round holes in their middles, of about four inches diameter; and, their bottoms being turned opposite the one to the other, they were cemented together with clay, forming a neck of junction thus of about three inches, with the small rising on the upper pan. The lowermost of these was more shallow, and about eleven inches wide, so as to cover exactly the opening at the neck of the jar, to which they luted it on with clay. The upper and opposite of these was about four inches deep, and fourteen inches wide, with a ledge round its perforation in the middle, rising, as is already said, from the inner side of the neck, of about half an inch high, by which a gutter was formed to collect the condensed spirit as it fell down; and from this there was a hole in the pan to let it run off by, to which hole they occasionally luted on a small hollow bamboo of about two feet and a half in length, to convey it to the receiver below. The upper pan had also another hole in it of about an inch square, at near a quarter of its circumference from the one below just spoken of, that served to let off the water employed in cooling, as shall be mentioned presently.

Their adkur being thus fitted to the jar, they complete the alembic by taking a copper pot, such as we use in our kitchens, of about five inches deep, eight wide at the mouth, and ten at the bottom, which was rather flattish; and turning its mouth downward, over the opening in the adkur, luted it down on the inside of the jar with clay.

For the cooler they raised a seat, close upon, and at the back part of the furnace, about a foot higher than the bottom of the copper pot. On this they placed a two or three gallon pot, with a round hole of about half an inch in the side of it; and to this hole, before they lighted their fire, they luted on a short tube of a like bore; placing the pot, and directing its spout so, as that when filled with water it threw a constant and uniform stream off it from about a foot high, or near the centre of the bottom of the copper pot, where it was diffused pretty completely over its whole surface; and the water falling down into the upper part of the pan of the adkur, it thence was conveyed through the square hole already mentioned, by a trough luted on to it for that purpose, to a cooling receiver a few feet from the furnace; from which they took it up again to supply the upper pot, as occasion required.

As their stock of water, however, in this sort of circulation, was much smaller than it seemingly ought to have been, being scarcely more than six or eight gallons, it too soon became hot; yet, in spite of this disadvantage that so easily might have been re-

medied, and the shortness of the conducting tube, which had nothing but the common air to cool it, there ran a stream of liquor from the still, and but very little vapour rising from it, beyond every thing I had ever seen from stills of a much larger size, fitted with a worm and cooler. In about three hours' time, indeed, from their lighting of the fire, they drew off full fifteen bottles of spirit, which is more by a great deal, I believe, than could have been done in our way from a still of twice the dimensions.

The inconveniences of a worm and cooler, which are also no small expense, I have myself often experienced; and if these could be avoided in so simple a way, and it might easily be improved, the hints that are here offered may be of some use. The thin metal head is certainly well adapted, I think, to transmit the heat to the water, which is constantly renewed, and which, if cold, as it ought to be, must absorb the fastest possible; whereas, in our way, the water being confined in a tub, that from the nature of its porous substance, in a great degree rather retains than lets the heat pass away, it soon accumulates in it, and becomes very hot; and though renewed pretty often, never answers the purpose of cooling the vapour in the worm so expeditiously and effectually as is done by their more simple and less expensive apparatus. In this country, more especially, where labour and earthen wares are so cheap, for as many rupees, and less, twenty furnaces, with stills and every thing belonging to them, independent of the copper pots, might very well be erected, that would yield above a hundred gallons of spirits a-day, allowing each still to be worked only twice. So very cheap, indeed, is arrack here, to the great comfort of my miners, and of many thoughtless people beside, that for one single peysa (not two farthings sterling) they can get a whole cutcha-seer of it in the Bazar, or above a full English pint, and enough to make them completely intoxicated, till they become objects often painful to be seen.*

DICTIONARY OF CHEMISTRY.

Fowler's Mineral Solution. *Tasteless ague drops;* a medicine in which the active ingredient is arsenite of potassa.

Frankincense, *olibanum.* A gum, the produce of the *juniperus licia,* which is brought from Turkey or Indostan in drops. It is yellowish-white, solid, hard, and brittle, has an unpleasant bitterish taste, and yields an agreeable odour when laid on burning coals.

French Berries. The fruit of the *rhamnus infectorius,* used as a yellow dye, the cloth being prepared in the same manner as for weld.

Friesland Green, *Brunswick green, ammoniaco-muriate of copper.*

Frigoric Mixtures. Substances which, on being mingled together, produce a great degree of thermometric cold.

Fritt. The name given to the materials of glass, when mixed and exposed to heat, but not melted.

Frost-bearer, *cryophorus.* An instrument invented by Dr. Wollaston.

Fuliginous. A characteristic of vapours, which, like smoke, are opaque, and have a tendency to deposit themselves on surrounding bodies in the form of a dark powder.

Fuller's-earth. The cleansing properties of this substance depend on the alumina it contains, which should not be more than one-fourth. The best we have is found in Buckinghamshire and Surrey. It contains 53 silica, 10 alumina, 1.25 magnesia, 0.50 lime, 0.10 muriate of soda, a trace of potash, oxide of iron 9.75, water 24.

* We have inserted this extract from Mr. Keir's account, as sent us by our Correspondent; because we think it illustrates, in a very complete manner, how much observation can effect, without what is called science. This rude Indian still is nearly as well adapted for the application of heat, as the best of our contrivances for the same purpose.—Ed.

FULMINATING POWDERS. We have already described the method of making some of these, and their properties, (Chemist, Nos. 10, 11, 17,) and here only add, that the most violent fulminations seem to require the presence of nitrogen.

FUMIGATION is a chemical process, having for its object to destroy contagious miasmata, or vitiated air. The most efficacious fumigating substances are chlorine and the vapour of nitric acid. Sometimes sulphur is burnt, gunpowder exploded, or vinegar heated for the same purpose, but neither of them does any good, except that the last gives a fragrant odour.

FUMING LIQUORS. That of Boyle is *hydroguretted sulphuret of ammonia;* that of Libavius is *chloride of tin, butter of tin;* that of Cadet is made by distilling equal parts of acetate of potassa and arsenious acid, collecting the product in glass vessels surrounded by a frigorific mixture. The liquor obtained emits a heavy noxious vapour, and inflames spontaneously in the air.

FUNGATES. The saline compounds of bases with an acid, lately discovered by M. Braconnot in mushrooms or *fungi*, and hence called

FUNGIC ACID.

FUNGIN. The woody part of the mushrooms, which remains after they have been exposed to the action of water and alcohol.

FURNACES. Instruments in which bodies are fused by heating. There are several sorts of them.

FUSIBILITY. The property of solids to be converted into fluids by heat; almost every substance requires a different degree of heat to fuse it.

FUSION. The state of the fused body.

FUSTET. A fine but not durable orange-coloured dye, obtained from the wood of the *rhus cotinus*, or *Venus's sumach.*

FUSTIC, *yellow wood.* The wood of the *morus tinctoria*, a native of the West Indies. It affords a yellow and permanent dye stuff.

ENGLISH FIRE-SIDES.

WE return to this subject, though with no feelings of satisfaction, for we have nothing to offer our readers in place of our present very imperfect and improper means of heating our apartments. "If we consider (says Mr. Boyce) the action of the well known principles of combustion, it will be evident that, in seeking to obtain warmth from an open fire, the party seeking is placed exactly at the *wrong end* of the apparatus. The only illustrative case at present occurring to the writer, and of which the aptness must apologize for the homeliness, is that of a person who, desirous of obtaining flour or meal, should expect to receive it by placing himself at the hopper or receptacle of the corn, before it has passed between the mill-stones. It is evident he is situated at the source of supply, and not of the produce: the raw material is rushing from him, instead of his receiving that which has undergone the beneficial process. The cases are perfectly parallel: the fire or combustion in the grate is continually drawing to itself fresh supplies of atmospheric air from all corners of the apartment; and consequently the radiation of heat in those directions is completely checked and overcome by the superior force of the cold current; whilst, fast as the supply undergoes the calorific process, it becomes rarefied, ascends, and is wasted through the obvious channel of the chimney."

Since we noticed the subject in our last, we have been to see Mr. Boyce's stove; and as far as we could judge, it answers very well for heating halls, libraries, and the two lower floors of small houses. In his house the thermometer stood at 60°, while one hanging outside the window was at 32°: and the fire that effected this, through the whole of the lower part of the house, was a small one, and was kept up by a small quantity of fuel. We see no objection to it after it is put up; but perhaps it would not be sufficiently powerful to heat the

house to the very top. But this is what Mr. Boyce says of it:—

"Some very considerable improvements in the form and construction of the Apparatus for supplying Warm Air, have been made by the author. It is usually placed on the basement floor, and may be fixed either within or without the building, being provided with a flue, to carry away the smoke arising from the fuel consumed in it. Around it a chamber or hollow space is then built, leaving a small channel open at the base, through which the atmospheric air enters, becomes warmed and rarefied, and is admitted at pleasure into the different apartments, by valves which regulate the supply. Nothing can be more simple, or less liable to be deranged by time or accident. The space occupied never exceeds a square yard, and it is generally fixed in a few days, with little trouble or inconvenience. To obviate any apprehensions that might be entertained from air heated by a metallic body, the author has succeeded in a method of constructing his apparatus, so that the air is heated by passing over a surface of pure porcelain, or earthenware; and, by a small addition, may also be rendered available to the fumigation of apartments, and the air supplied be impregnated with the requisite degree of moisture or perfume. Any kind of fuel may be used; and, from the rapidity of the draught, the flue never requires cleansing, which alone is no inconsiderable exemption from trouble and expense. The current of air thus supplied may be at any temperature above the common atmosphere most agreeable to the feeling; and it is almost unnecessary to state, that, upon being analyzed, air moderately heated has always been found to contain the same due portions of its constituent parts as when at the common temperature."

The expense of putting up this apparatus for small houses, say a house of ten rooms, such as the greater part of the houses now constructing about London, Mr. Boyce estimates at 50*l.* sterling; but we have good reason to believe it would cost a much larger sum. This sum would, probably, be saved in the course of two years in fuel and stoves, wherever three fires are kept; but this is too large a sum for those classes who, more than any others, need the healthful benefit of artificial heat. In time, we have no doubt, improvements will be made, so that Mr. Boyce's, or some other similar plan, but much cheaper, will be adopted. In the meantime, we beg leave to recommend two principles to the attention of all those who may be fitting up or building houses. By following these, or adapting them as circumstances may direct, much improvement will be introduced.

The first is, that the air for the supply of the combustion of the fuel should come directly from the outside of the house into the fire, and not be abstracted from the apartment. It is essential to cheapness and comfort, that the air once heated should not be carried off by the chimney; and the only means of preventing this is to supply the grate by another source. But the most important principle is to have no chimneys. In Mr. Boyce's house there is a flue from the stove, which does not take air from the apartment; there is a kitchen chimney for the purpose of cooking, and the chimney in the drawing-room; every other chimney is stopped up. It strikes us, from the known expansibility of air, that if our houses were constructed without chimneys, or those that we have were stopped, that a comparatively small stove or oven, such as shops are heated with, placed on the lower floor of the house, the upper floors having holes through them to permit the free ascent of the heated air, would answer all the purposes of Mr. Boyce's pipes and patent stove. But we must again conclude, by regretting there is not something more definite; and that that which is definite is not cheaper.

ELASTICITY OF METALS.

To the Editor of The Chemist.

Sir,—If you will permit me, I shall offer to your consideration a few remarks on the elasticity of metals, as compared with that of gases. I shall apply to the Chemical Dictionary, No. 43, for a definition of the subject. "Elasticity is applied in chemistry to signify the power of gases to expand when pressure is removed; as well as to signify the capability of metals, when formed into bars or rods, of being bent, and still retaining the power to return to their original position whenever the force which bends them is removed. There seems little analogy between the two species of elasticity." I feel assured, Sir, I shall be rendering you an acceptable service, by endeavouring to point out those particulars in which the resemblance, however small, which avowedly does exist between them, is discernible.

Elasticity, then, is that power possessed by the particles of a body, which, when they have been compressed, by some superior force, into a state of unnatural approximation towards each other, causes them to expand, and to occupy the space they originally filled, whenever the force which oppresses them is removed. This property is possessed by the gases in a very eminent degree. Mr. Boyle, by means of an air-pump, caused a portion of atmospheric air to fill nearly fourteen thousand times the space it usually occupies. The elastic power of a gas is in proportion to its compressibility. For instance: Carburetted hydrogen is compressed by the "Portable Gas Company" into a thirtieth part of its volume; and, if allowed to escape from one of their vessels, the gas, by its elastic power, would immediately expand, and occupy a space thirty times as large as the vessel in which it was confined. Now, at the first glance, this may appear to be totally distinct from that property of an elastic metal, which, when a rod is bent, inclines it to revert to its original position, whenever the controlling force is removed; but if we examine them a little more closely, we may perhaps find, that the cases are by no means so widely different as might be expected. When a bar of steel is bent in the form of a bow, it is evident that the particles composing the inner circle of the bar must be forced into a closer contact with each other, than those which constitute the outer circle. When, therefore, the controlling force is withdrawn, the particles of the metal which had been compressed into a state of unnatural propinquity, immediately exert their elastic power, regain their former situation, and the bar is restored to its original straight position.

From these considerations, I think it may be fairly concluded, that although the analogy between the two species of elasticity is by no means striking, yet there are a few points in which they do bear some resemblance to each other. If I have succeeded in tracing these points to your satisfaction, the insertion of the foregoing remarks will oblige,

Yours, respectfully,

Feb. 1. N. R.

ATTRACTION.

To the Editor of The Chemist.

London, Jan. 28.

Sir,—I remember an observation in one of your early Numbers, where you recommend to young students in chemistry to analyze every theory, however plausible, that may come under their notice, and *to take nothing for granted.* My respect for that maxim has induced me, in my hitherto limited studies, to adhere to it, which I hope will excuse my presumption, if there be any, in what I am going to say. I was at a public lecture some short time ago, and amongst a variety of amusing experiments, the lecturer, who is an eminent chemist, exemplified the theory of chemical affinity in metals, by causing two pieces of lead, each about the size of a large pear, and

smoothly flattened at the larger end, to cohere, and the affinity he proved to be very great, as it required the strength of two persons to separate them again. I could not satisfy my mind at the time why these two pieces of lead should possess such cohesive powers when joined together with smooth surfaces, and yet show no properties of attraction when placed in less intimate contact. At length I began to think that the cohesion of the two substances arose from the complete expulsion of the air from between their polished surfaces. I remember, too, that when I was a school-boy my schoolfellows used to amuse themselves with a plaything called a sucker, which was made by cutting a piece of leather into a circular form, of a few inches diameter, and through the centre of which a piece of string, by way of handle, was inserted; the leather was then well wetted, and by being pressed upon a flat stone, so as to lay perfectly smooth, and afterwards drawn up by the string, it would lift a stone of very considerable weight. Whether I am right or not in the analogy between our school-boy amusement and the grave experiment of a chemical Professor, I have to beg you will be the medium of deciding. As I have not the convenience of an air-pump, perhaps some of your readers, who possess, like myself, the temerity to doubt the stability of an acknowledged principle, will dispel my doubts by trying this experiment in an exhausted receiver, which may be accomplished by procuring the two substances at any of the opticians', for the cost of only a few pence, and they shall be abundantly remunerated by sharing the honour of this brilliant discovery.

I am, Sir, yours, &c.
R. C.

A NEW DYE STUFF.

(*By J. B. Boussingault.*)

All the American races have a practice of painting their skin, and in general they seem to prefer a red colour. The Indians who dwell on the Oronoco, and on its tributary streams, employ for this purpose two species of colouring matters, one is called *onoto*, and the other *chica*. The former is the produce of the *bixa orellana*, the second is extracted from the leaves of a plant of the family of *bignoniacées*, which was made known in Europe by MM. Humboldt and Bonpland. The *bignonia chica* bears leaves of a very fine green, which become red on being dried; and if chewed they impart a red colour to the saliva. To extract the colouring matter from these leaves, the Indians boil them a long time in water, strain off the water, carrying with it the colouring matter, and add to it some pieces of the bark of a tree called *aragane*, which hastens the precipitation of the red substance. The precipitate is carefully washed, made into cakes five or six inches in diameter and two or three inches thick, and dried.—Under this form it is met with in commerce; it has the colour of cinnabar, is without taste or smell, and is heavier than water. It resembles indigo, except in its colour, stains the fingers like it, and takes a metallic lustre by being rubbed.

By heat *chica* is decomposed without melting, and without spreading an ammoniacal odour. After calcination there remains a pulverulent charcoal, which, on being incinerated, left behind an earthy substance amounting sometimes to a third of the red matter calcined. Neither hot nor cold water dissolves *chica*, but the water acquires a slight fawn colour, probably proceeding from some extractive. Alcohol digested on *chica* became of a fine red, and if heated seemed to dissolve still more of the colouring matter. By spontaneous evaporation the red matter in a solid state is obtained from the alcohol, and is of a browner tint than the *chica* of commerce. Chlorine discoloured very speedily the alcoholic solution. The residuum obtained by evaporating the alcoholic solution was entirely dissolved by sulphuric ether, which acquired a beautiful yellow-orange

colour, and on being evaporated left the colouring matter in the state of a very fine powder.

Although insoluble in water, the chica is not precipitated from its alcoholic solutions by this fluid, in however great quantities it may be added; but if heated or exposed to the air, owing to the evaporation of the alcohol, the chica is deposited. When obtained from the alcohol solution, it is readily dissolved by potassa, and by carbonate of potassa. Lime-water, agitated with chica, acquired a light red tint; ammonia dissolves chica readily, and the solution, at first of a yellow-orange, became, after a little, of a deep yellow. On the alkali being spontaneously evaporated, a residuum was obtained of the colour of bistre. Acetic acid poured on chica acquired a red colour, and afterwards deposited a portion of the substance of a beautiful carmine. Oils seem not to be capable of dissolving chica, but it mixes with them, and gives them a beautiful lake colour. The Indians mix it with fatty substances to smear over their bodies.

The chica, M. Boussingault adds, is already employed in dying, and when fixed in cotton gives it a yellow-orange colour; and it is to be wished that it may be employed in Europe, where it will certainly be of advantage.' The editor of the *Annales de Chimie et de Physique*, from whose journal we have translated this Article, adds, that some specimens were brought to Europe by MM. Humboldt and Bonpland; and that M. Merime has ascertained, by numerous experiments, that chica may be advantageously employed in the arts.

MR. JEFFREYS' SMOKE CONDENSER.

To the Editor of The Chemist.

SIR.—In Saturday's Number of your Publication now before me, I see a quotation from the *Quarterly Journal of Science*, in which it is stated, that Mr. Jeffreys, of Bristol, has taken out a patent for the invention of a smoke condenser.

In 1822, Messrs. Symons and Co. cotton-manufacturers, in Leman-street, were indicted for a nuisance in erecting a steam-engine, I offered them a plan, similar in every respect to Mr. Jeffreys', for condensing the smoke, but they did not adopt it; and since then, I have proposed it to several other persons, but have not hitherto had it in my power to carry it into effect.

I am, Sir,

Your most obedient servant,

55, *Great Prescott-street.* W. J.

TO CORRESPONDENTS.

We believe the Query alluded to by "A Subscriber," appeared in the pages of a cotemporary publication.

Though we have inserted the Queries of "A Subscriber" and of "W. C.," we must at the same time say, The Chemist is unacquainted with any fluid which dissolves gum with greater facility than water. It is insoluble in alcohol, and the strong acids decompose it. "W. C." is informed, that muriate of soda may be decomposed by carbonate of potassa; and some of the crystallized *soda* of commerce is so obtained. In the manufacture, however, of muriatic acid, vast quantities of sulphate of soda are procured; and this is again decomposed by being roasted with chalk in a reverberatory furnace, supplying a considerable quantity of carbonate of soda, which, when thus obtained, comes, we believe, into the market as cheap as barilla.

We had no other reason for not inserting the communication of "Davidis," though he calls our conduct unfair, than conceiving the Articles on Electrical Jars, which have appeared in our pages, would satisfy him. He will see, that if we have *hobbies* we do not ride them very sturdily.

"An Old Friend" has been received; but we must defer till our next farther notice of his communication.

We return our thanks for the communication of "A Subscriber," relative to pyrometers; we shall insert it in a future Number.

"Quæsitor" and "Humanitas" have come to hand.

*** Communications (post paid) to be addressed to the Editor at the Publishers'.

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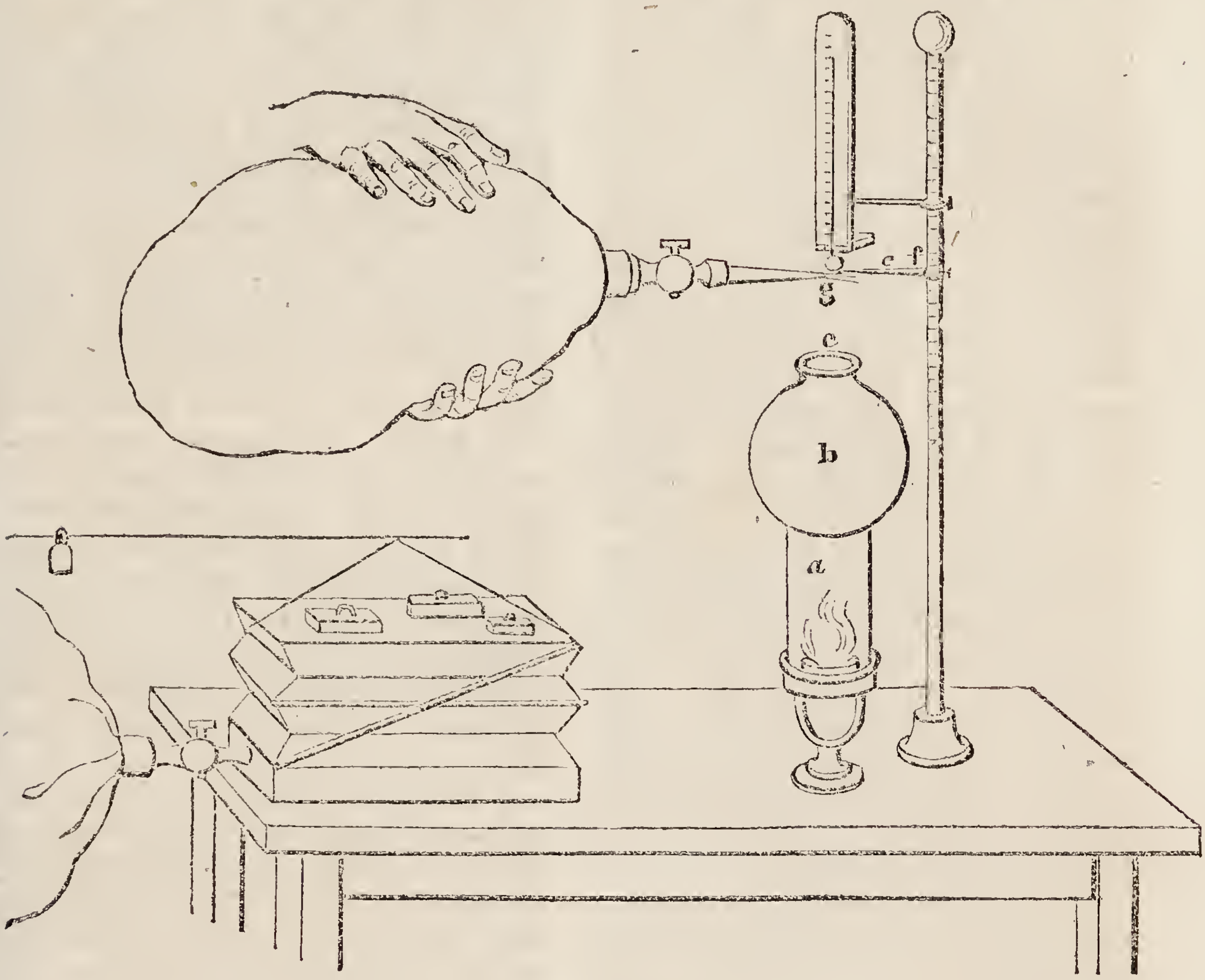

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TEMPERATURE OF FLAME.

(*Mr. Gurney's Experiments.*)

"I NOW made a uniform current of carburetted hydrogen or coal gas to pass through small apertures, similar to a common gas burner, *h*, by a regular pressure made by a column of quicksilver; I surrounded this with a cylinder of copper, *a*, which occasioned a draft of air from below through it; in its

passage through this chimney, the atmospheric air became heated by the flame of the burning gas; on the top, and communicating with this chimney, I placed a globe of copper, *b*, in which the air became more generally and perfectly heated; out of this globe it passed by an opening in the top, *c*. I now placed a thermometer, *d*, and corresponding index, *e*, perpendicularly over this orifice, on a moveable slide, *f*, this enabled me to fix it at any given distance; by which means I could read off any temperature it indicated, at any given elevation perpendicularly over the opening in the globe. The thermometer was now fixed at a point which indicated a temperature of 428°; and on this spot I made a small stream of *hydrogen gas* to issue from a small jet, *g*, and found that it instantly inflamed. It will be evident that at this point the atmospheric air, or supporter, was heated to a temperature which was correctly indicated by the thermometer to be 428°: the stream of hydrogen, or combustible substance, was so small, and the heat so generally diffused, that it instantly became of the same temperature with the supporter, and consequently inflamed.

"The carburetted hydrogen which was burning within the instrument, and supplying heat to the air, both within and above the globe, was made in this case to be always of the same quantity and same force by the pressure of a given column of quicksilver; because in this instrument uniform pressure is absolutely necessary, otherwise the heat and flame would constantly vary, and no true temperature could be read off. In the instrument now represented in the plate, I have made a very different contrivance for regulating uniformity of pressure, and find it, from experiment, capable of measuring with the greatest correctness, every possible force of pressure from five grains to a square inch, up to five hundred. It will be described hereafter, as it is the instrument by which I have discovered many other very interesting facts relating to gaseous bodies.

"I tested *carburetted hydrogen* gas by the same means as the above, and found the temperature at which it inflamed to be at about 500°. *Solid* bodies may be tested by the same instrument. In order to ascertain the temperature at which they inflame, nothing more is necessary, than to place the smallest morsel of the substance to be examined on a fine platinum wire, and to hold it at various distances above the opening of the globe, until the precise point is seen at which it takes fire: the true temperature of this point is then to be measured, by bringing the bulb of the thermometer to the spot. In this manner I found that *solid bodies*, phosphorus, sulphur, camphor, &c. inflamed, and sublimed, at the exact temperatures given by the usual methods; and this circumstance convinced me that the results I gained respecting *gaseous bodies* were substantially correct; or, at all events, that the principle of the instrument was true.

"These experiments may be made, although not in so correct a manner, by using a common argand or spirit-lamp, instead of that uniform and steady flame produced by the instrument in question. It will be found by any one who tries the simple experiment, that a stream of hydrogen gas will inflame, over a common lamp, at a point where the *hand may be held without pain* for many seconds; which fact must convince him that the high temperatures which are usually stated as necessary for this purpose, are altogether incorrect; and that the errors have originated from some inaccuracy in making the experiments, or from not taking into consideration the habitudes of this form of matter."

It is hardly necessary, perhaps, to remind the reader, that the *fact* stated by Mr. Gurney, as to the *low* temperature at which gases inflame, is that to which we wish

to direct his attention. He will see, by turning to page 182, that it is by cooling gas below the point of inflammation, which is stated by Sir H. Davy and Mr. Brande to be very high, that the safety lamp is of use. Mr. Gurney's assertion, therefore, that the gases, under certain circumstances, inflame at a lower temperature, shows, if true, that the safety lamp is not so valuable an instrument as it has been represented. We give these experiments as Mr. G. gives them, without saying one word as to their validity, merely remarking, that on account of his assertion the subject is worthy of further investigation. The following letter suggests a means of obviating one of his objections.

To the Editor of The Chemist.

Sir,—I observed in *The Times* paper, a few days since, a letter by Mr. Gurney, on the subject of the patent safety lamp. Without entering into the question, whether the "illustrious individual" to whom the credit of the invention is generally attributed be justly entitled to it or not, a feeling of humanity alone would induce any one to assist if possible in the accomplishment of so desirable an object. I have too high an opinion of Mr. Gurney's integrity, and too great a respect for his talents, to suppose he was actuated by any other motive; but one of the causes of its inefficacy, as stated by him, is so easily obviated that I am surprised he did not suggest it, viz.—That the gauze is not impervious to the explosive gases when propelled by a strong blast, as is sometimes the case. Would not a glass cylinder on the outside of the gauze effectually prevent this?

I am, Sir,

Your obedient servant,

Humanitas.

LECTURES AT THE ROYAL INSTITUTION.

SULPHURIC ACID. PHOSPHORUS.

Lecture 23. In this lecture Mr. Brande proceeded to describe the dry or anhydrous sulphuric acid, or the acid as it exists combined with bases, and which it is supposed has been obtained pure, under the name of the fuming sulphuric acid. There was a doubt of the separate existence of this dry acid, but the experiments of M. Bussy, lately published, and who has clearly proved that the fuming quality was not owing to sulphurous acid, as suspected, seems to have set the question at rest; and the dry acid may be obtained by the distillation of green vitriol. Common liquid sulphuric acid is, then, a compound of dry sulphuric acid and water.

It has long been an object with the manufacturers to procure sulphuric acid without the assistance of nitre, and this has been performed by a gentleman of the name of Hill, who has taken out a patent for this purpose. He subjects pyrites in a state of powder, or sulphuret of iron, to a strong red heat, in cylinders communicating with a chamber lined with lead, and containing water; and it is found that the sulphur evolved by this means, and burning, produces sulphuric acid, which is immediately condensed in the water. The great advantages of this method are, that no nitre is necessary, and a pyrites, which was before hardly put to any use, is the material employed for furnishing the acid. The improvements in the manufacture have been so great, that a pound of acid, which twenty years ago cost 7*d.* may now be had at the wholesale price for less than 2*d.* Sulphuric acid also exists, or is found native, in volcanic countries. This substance is frequently used for domestic purposes, and from this circumstance, is sometimes swallowed by mistake, and then acts as a most virulent poison. It might be expected, so acrid is this substance, that, when taken into

the stomach, it would instantly destroy the parts, and produce immediate death. It does certainly produce death; but cases have been known in which a considerable quantity of this poison has laid for some time in the stomach without destroying it. The living powers of this organ seem of themselves to furnish something like an antidote to this deleterious substance. There is a viscid mucus produced, which for a time protects the stomach from its further ravages, and when the sulphuric acid is rejected, it is found to be blackened, and its properties partly destroyed. Mr. Brande then mentioned the remedies, which, as we have recently given them, we shall not repeat, but only remark, that he recommended carbonate of magnesia, while Orfila recommends, with good reason, we think, pure magnesia, as not occasioning the patient any trouble by the emission of carbonic acid gas. Mr. Brande also mentioned whiting and chalk as useful remedies.

Sulphuric acid combines with ammonia directly, by putting a small quantity of the acid in ammoniacal gas; the salt is of no importance in itself, but as its formation is a step in the process of obtaining muriate and carbonate of ammonia. Before passing on to treat of the union of sulphur and chlorine, Mr. Brande summed up his account of the compounds formed by the union of sulphur and oxygen, and remarked that they were all acids, no oxide of sulphur having yet been discovered. It is also a disputed point whether the hyposulphuric acid is to be considered as a separate compound, or only a mixture of sulphuric and sulphurous acids; but this point will be better discussed when treating of the salts formed by the union of these acids and bases.

When sulphur is heated in chlorine, it absorbs about twice its weight of this gas, and forms a yellow coloured liquid, which is chloride of sulphur. This substance acts on the brass necks of retorts, and therefore it is made in a retort having a curve in its neck, the yellow coloured liquid forming and condensing in the curve. It is a compound of 1 proportional sulphur, 16, and 1 chlorine, 36, its equivalent being 52. Its specific gravity is to water as 16 to 10. It is decomposed by water, and sulphurous, sulphuric, and muriatic acids are formed, and sulphur is deposited. Before mixing it with water it manifests no acid properties; but on the admission of water or atmospheric moisture, it instantly converts vegetable blues to red. In this case, too, the water is decomposed, the hydrogen going to the chlorine to form muriatic acid, and the oxygen uniting with the sulphur to form sulphurous and sulphuric acids.

Sulphur and iodine also combine; but the compound is of no importance.

Sulphur and hydrogen combine, and form a gas called sulphuretted hydrogen. This gas is produced directly by subliming sulphur in hydrogen; they combine in small quantities, and slowly, and form sulphuretted hydrogen gas. It is more generally obtained, however, by pouring dilute sulphuric acid on sulphuret of iron; the sulphur then meets with the hydrogen in a nascent state, and combines with it more readily: 100 cubic inches weigh 36 grains, and its specific gravity is to air as 1.1934 to 1.0; to hydrogen as 17 to 1. It is slowly absorbed by water, which takes up nearly thrice its own bulk of the gas; but notwithstanding this it can be collected over water. It has a very strong flavour and smell, resembling those of rotten eggs, and when mixed with water imparts to that fluid a taste and smell resembling several mineral waters, such as those of Aix la Chapelle and others. Under a pressure of seventeen atmospheres this gas is liquefied. It is inflammable, and burns in contact with the atmosphere, but it extinguishes flame. When burnt, water is formed and sulphur deposited, the heat not being enough to inflame

it. When breathed, even diluted with a large quantity of atmospheric air, it is extremely deleterious, and is fatal to animal life. One of its distinguishing properties is, that it discolours almost all metallic solutions. Some of it was prepared over a water trough, the fluid in which held some metal in solution, and it was gradually discoloured as the sulphuretted hydrogen was formed. From this property it is employed as a test for lead and other metals held in solution, and is in this point very useful. It is perhaps fortunate for the people of this metropolis that most of the compounds of lead are so heavy that they fall to the bottom of water; otherwise the practice of keeping water in leaden tanks, and conveying it through leaden pipes, would prove much more injurious to the health. By its means we can almost always tell if a metal be present, but not so well what metal it is. Sulphuretted hydrogen reddens vegetable blues, and hence it has been called an acid; but this is not a certain test for an acid, as some bodies possessing alkaline properties have the same effect. Gay Lussac has called sulphuretted hydrogen hydrosulphuric acid; but the common sulphuric acid is a hydrosulphuric acid, and the name sulphuretted hydrogen is to be preferred.

When one volume of sulphuretted hydrogen and one and a half of oxygen are fired by the electric spark, decomposition ensues, water is formed, and sulphurous acid is produced. The sulphurous acid is one volume, whence it is inferred that sulphuretted hydrogen consists of one volume sulphur and one hydrogen, the hydrogen being 1 and the sulphur 16; the equivalent for sulphuretted hydrogen is 17, the hydrogen suffering no condensation, and the volume of the compound being the same as the volume of the hydrogen. The gas is also decomposed by passing electric sparks repeatedly through it, when the sulphur is thrown down. In this experiment it would seem that the expansion of the gas by the heat was the cause of its liberating the sulphur.

Chlorine decomposes the gas also, forming muriatic acid with the hydrogen, and sulphur is deposited. Iodine also decomposes it, forming, in like manner, hydriodic acid, and depositing sulphur. This experiment is of some consequence, as supplying us with the easiest mode of obtaining hydriodic acid, which seems likely to become useful in the arts, from the colouring matter it forms with some metals. The best way, perhaps, of obtaining this acid is to pass sulphuretted hydrogen gas through a mixture of water and iodine. The liquid is afterwards to be concentrated by evaporation, which drives off the excess of sulphur, and liquid hydriodic acid remains. Nitric acid produces, with sulphuretted hydrogen, a deposit of sulphur, forming nitrous oxide.

Sulphuretted hydrogen and ammonia unite in equal volumes, and form hydrosulphuret of ammonia, formerly called the fuming liquor of Boyle, from its having been discovered by him. It is of great use as a test for the metals, and is procured by distilling, in a strong heat, a mixture of 6 parts of slaked lime, 2 muriate of ammonia, and 1 of sulphur. On dropping this substance into a metallic solution it occasions a precipitate, and we can generally know what the metal is by the colour.

Sulphur and nitrogen, as far as we know, have no action on each other, and form no definite compound, though the nitrogen emitted during the decomposition of animal substances appears sometimes to contain sulphur.

Mr. Brande concluded his lecture by introducing the subject of phosphorus to the attention of his auditors. As his remarks were confined to the mode of procuring this substance and to its properties, both of which have already been described in our pages, we shall not repeat his observations, but only give that part of his lecture which relates to the compounds of

this body, as this is a subject never yet mentioned in The Chemist.

Mr. BROUGHAM on EDUCATION.

This friend to man generally, and more especially to the working classes of this country, to diffuse education and knowledge among whom he has long laboured, and is now more than ever earnestly labouring, has just published a pamphlet, entitled, "*Practical Observations upon the Education of the People, addressed to the Working Classes and their Employers.* We should, perhaps, be more zealous in recommending this pamphlet to the notice of our readers, and encouraging the opulent to distribute it among those who may not be well able to afford it,* were it not that our own labours are mentioned in it among the useful and valuable cheap publications of the day, with more praise than, we are afraid, they deserve. We must not, however, omit to observe, that at present, when so many societies are forming for the diffusion of knowledge, this pamphlet is remarkably well-timed, and contains a great number of most judicious observations as to the principles on which societies should be formed and conducted. We are happy to observe, that Mr. Brougham is a strenuous advocate for the great mass of the people not suffering themselves to be educated, or in other words *drilled*, by some few of their fellow-men. He strongly recommends that, as they clothe and feed themselves, so they should provide for themselves that species of instruction which they think best adapted to their wants and most conducive to their interests. The management of their seminaries, he also thinks, should remain entirely in their own hands. In these opinions we cordially concur; and having in more than one instance seen the slow-paced, quiet, unimproving and unimprovable uniformity which results from a national education directed by the government of a country, we must say, there can, in our opinion, be no greater evil, than for a whole community to give up to some few individuals in it the power of prescribing to them what they may, and what they must not, learn. Ignorance is sometimes wisdom; and we would rather see our countrymen, if there were no other alternative, uninstructed than taught mental slavery. Mr. Brougham's pamphlet, in describing what has been already done in this country by the people for their own education, and in laying down the principles on which they ought to proceed, is admirable. The concluding paragraph we shall quote, as holding out,—more perhaps by Mr. Brougham's own example, labouring at night after his irksome professional toils are over, which it records, than by what it says of others,—a strong stimulus to mental industry:

"To the Working Classes I would say, that this is the time when by a great effort they may secure for ever the inestimable blessing of knowledge. Never was the disposition more universal among the rich to lend the requisite assistance for setting in motion the great engines of instruction; but the people must come forward to profit by the opportunity thus afforded, and they must themselves continue the movement once begun. Those who have already started in the pursuit of science, and tasted its sweets, require no exhortation to persevere; but if these pages should fall into the hands of any one, at an hour for the first time stolen from his needful rest after his day's work is done, I ask of him to reward me (who have written them for his benefit at the like hours) by saving threepence during the next fortnight, buying with it Franklin's Life, and reading the first page. I am quite sure he will read the rest; I am almost quite sure he will resolve to spend his spare time and money, in gaining those kinds of knowledge which from a printer's boy made that great man the first philosopher, and one of the first statesmen of

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* The profits are to go to the London Mechanics' Institution.

his age. Few are fitted by nature to go as far as he did; and it is not necessary to lead so perfectly abstemious a life, and to be so rigidly saving of every instant of time. But all may go a good way after him, both in temperance, industry, and knowledge, and no one can tell before he tries how near he may be able to approach him."

QUERIES.

To the Editor of The Chemist.

Sir,—If a person looks at a lighted candle or lamp with his eye half closed, (or, more properly speaking, winking,) there appear to be rays of light darting upwards and downwards in the atmosphere; an explanation of this phenomenon will oblige

Deptford. Y. Z.

Sir,—Having had the misfortune to spill a quantity of ink on a boarded floor, I shall esteem it a great favour, if you will inform me which is the best means of taking out the stain. I have tried a preparation sold for that purpose, also spirits of salt and oxalic acid, but all to little effect, the places turning red according to the test published in The Chemist (p. 151.)

I remain Sir,
Yours, respectfully,
A Reader of The Chemist,
London, Jan. 31. W. T.

Sir,—Probably some of your Correspondents will explain to me, why the calcined magnesia of Apothecaries'-hall is so much heavier than what I can myself make, by following the precise directions of the London Pharmacopœia?

I am, Sir, &c. H.

Sir,—It would be of great use to me, if you, or any of your numerous Correspondents, could inform me of the best method of bleaching tallow for candles.

I should also like to know, whether quicksilver can be completely oxidized by the usual method of preparing the *unguentum hydrargyri fortius*, or strong mercurial ointment, by rubbing it in a mortar, with a heavy pestle, with hog's lard. It strikes me that, by this process, it is only subdivided, and that the quicksilver is actually rubbed into the skin in a metallic state.*

Your sincere well-wisher,
J. G. W. H.

The best method of making a clear and lasting red ink?

ANSWERS TO QUERIES.

To the Editor of The Chemist.

Mr. Editor,—Having seen in your 46th Number, a Query, as to the best method of gilding trinkets, I send you the following receipts, taken from Mr. Carey's 500 Useful and Amusing Experiments, for making an amalgam, and to gild an alloy:—

TO PREPARE THE AMALGAM.

Put a small quantity of gold, quite pure, with about six times its weight of mercury, also quite pure, into an iron ladle, or crucible, which has been previously rubbed in the inside with whitening, then put it upon a charcoal fire, and submit it to a gentle heat, occasionally stirring the metals with an iron wire. The heat should not be so strong as to evaporate the mercury, at least not till the solution of the gold is nearly effected; the heat may then be increased for a moment, till a vapour is seen to rise from the crucible. When the amalgam is formed it is to be thrown into water, where a small quantity of mercury will be seen to separate from it. To free it completely from mercury, it will be necessary to twist it up in a piece of fine wash

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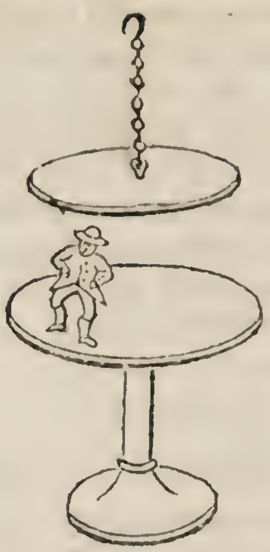
* We know it frequently occurs, that the mercury is not oxidized by this process, and consequently it is very often met with in a metallic state in the ointment. The best chemical authorities we are acquainted with say, that experiments are yet wanted to decide, whether the the mercury is oxidized or merely mechanically divided.

leather, and to press it gently betwixt the finger and thumb. The mercury will then pass through the pores of the leather and leave the amalgam fit for use, of a fine white colour.

TO GILD AN ALLOY.

Clean the surface of the article to be washed or gilded, by immersing it in diluted nitric acid, and then in water, to prevent the farther action of the acid before the gilding is performed. The article is then to be put into an acid called the *quickening*, which is made by dissolving a little mercury in nitric acid, so as to give it a milky whiteness. The article is to be dipped in this, which will give it a coat of the solution in an instant. After this, the amalgam prepared by last experiment is to be applied to it with a pencil, made of a piece of flattened wire fixed in a handle. This pencil is to be occasionally dipped in the quickening, and the amalgam touched with it; a small quantity will thus adhere to the pencil, and when rubbed upon the work, will spread or flow in an instant over every part which has been touched with the quickening. The mercury is next to be driven off by holding the article in a pair of iron pincers over a charcoal fire, till it change from a white to a gold colour; but as the mercury is apt to flow, during this process, more to one part of the article than another, it must be spread with a brush made of soft hog's hair. After the mercury is completely driven off, the article will have a dull scarfy appearance; but upon being rubbed with a small brush, made of fine brass wire, previously dipped in small beer or ale grounds, it will assume a polished surface.

A mixture of copper and brass is the metal most commonly employed for this kind of gilding. Silver may also be gilt in the same manner; but pure copper, iron, and steel does not take the amalgam.



ELECTRICAL ATTRACTION.

Procure two metallic circular plates, (copper or brass answer best) and place one of them upon the table, or a stand, under the prime conductor of the machine, and suspend the other from the prime conductor right over the other plate, about three inches from it. Upon the lower plate place a number of light objects, such as small pieces of gold leaf, paper, &c., cut in the form of men, birds, &c.; then turn the machine, and they will begin to be agitated, and leap about in a very fantastic manner.

GOOD INK.

To the Editor of the Chemist.

Mr. Editor,—Having noticed an inquiry in your pages after a receipt for making good ink, I beg to hand you the following, which proceeds from high authority, and is pronounced both theoretically and practically excellent;—Take 8 oz. of nut-galls in powder, 4 oz. of logwood chips, 4 oz. of sulphate of iron, 3 oz. of gum, 3 oz. of gum arabic in powder, 1 oz. of sulphate of copper, and 1 oz. of sugar-candy. Boil the galls and logwood together in 12 oz. of water for an hour, or till the water has evaporated to 6 oz. Strain the decoction through a hair sieve or linen cloth, and then add the other ingredients, stirring them well together till the whole is dissolved, especially the gum. Leave the mixture 24 hours to sub-

side, then pour off the supernatant liquor and bottle it, corking it well. It is now fit for use.

I am, Sir,
Your obedient servant,
A WRITER.

ENGLISH FIRE-SIDES.

WE have already pointed out many of the inconveniences of our present mode of heating houses; and as there is no single point of domestic economy more conducive to comfort and health, we are glad to bring before our readers any suggestion at all tending to improve this part of our system. The principle adopted in the stove, of which the following description has been given in the *Philadelphia Gazette*, has long been known, and may probably be advantageously acted on:

THE COMPENDIUM STOVE.

BURNING OF WATER!—Our town (or at least a part of it) has been kept in a state of excitement for three days and a half, by a discovery which has been made of a mode of using *water for fuel!* The proprietors of coal-mines and woodlands are all in alarm—(by Monday we may expect that the panic will spread among the wood-sawyers and coal-heavers)—the question whether it will be advisable to let the Liberties have the Schuylkill water, now we have this new use for it, already begins to be discussed—and fears have been expressed lest our Professor of Pyrotechny should carry his art so far as to set fire to the Delaware! As he has, however, given his word and honour that before he attempts any thing of this kind he will give suitable notice, so that the ships may be removed, no apprehensions on this score need, for *the present* at least, be entertained. In the existing state of public feeling, those, perhaps, are most rational who talk of petitioning Council to assess an additional tax on such as *burn* the Schuylkill water as well as *drink* it.

Seriously and soberly—Mr. Augustus Day, who resides at No. 124, North Third-street, has invented a stove, by which it has been calculated a room may be kept warm for a whole day, and no more than *four cents worth* of Lehigh coal be consumed in that period. It is of small size, and in shape an inverted cone, with several longitudinal openings near the apex. On a grate within rests a small quantity of coal. A pan of water placed beneath the openings ensures a constant supply of vapour. In passing through the ignited coal, the aqueous vapour is decomposed, and we have that powerful heat which is produced by the combustion of oxygen and hydrogen. The cover of the stove is attached to a moveable section of pipe, which is raised and lowered by a fixture similar in principle to that of a suspended lamp, and by this contrivance the fire is regulated. So powerful is the heat, that a small quantity of water thrown into the stove is immediately decomposed, and the combustion of its component parts follows of course. Of this we have ourselves been witness.

The *principle* of the invention has long been applied in the mechanic arts, especially by the *blacksmith*, who, as is well known, when he wishes to increase the heat of his fire, throws on it a small qantity of water. Of late years, chemists have, in their compound blow-pipes, made sundry new and very valuable applications of this principle; but the honour of applying it to domestic economy belongs to Mr. Day alone.

LIFE OF BERTHOLLET.

(*Continued from p.* 261.)

[ON looking back we see we forgot to state, that we took the Article under this title from the *Annals of Philosophy;* and we have to regret that this journal now offers so little to us which is either interesting or instructive.]

In the course of his investigation into the nature of chlorine, Berthollet discovered chlorate of potash. This he proved to consist of potash united to an acid composed

of muriatic acid and a larger proportion of oxygen than he supposed to exist in chlorine: to this acid he accordingly gave the name of hyperoxygenized muriatic acid. One of the most remarkable properties of this salt is the great proportion of oxygen which it contains. This oxygen is retained, united only by a very weak affinity, and of course is easily disengaged by presenting any of the combustibles with which it readily combines. Berthollet, who was ever the first to foresee the practical application of any of his discoveries, proposed that the new substance should on that account be substituted for nitre in the manufacture of gunpowder. His hint was immediately acted upon, and a manufactory was established at Essone. The effects, however, were lamentable. No sooner had the workmen begun to triturate the mixture of chlorate of potash, sulphur, and charcoal, than the whole exploded with tremendous violence, the building was blown into the air, and several persons perished.

The discovery of this substance has, however, been productive of no small advantage to science. Without it, the two oxygen-acids and the two oxides of chlorine had never been known, and cannot yet be prepared; without it, the chemist would be deprived of an extremely easy and economical mode of preparing the purest oxygen gas; and without it, Gay Lussac and Thenard had not been enabled accurately to disclose the ultimate composition of vegetable and animal principles.

But the researches of our chemist with respect to the nature of chlorine were attended by yet another result, which has redounded, not less to his own honour, than to the prosperity of France and England. It had been previously remarked by Scheele, that among other extraordinary features, chlorine is characterised by the property of destroying every vegetable colour with which it comes in contact; and this destruction he found to be not merely apparent but complete. The vegetable colour treated with chlorine cannot be restored by any known chemical reagent: its basis has undergone decomposition.

Since chlorine destroys vegetable colours completely, Berthollet reasonably inferred that it would produce a similar effect upon those substances which injure and obscure the inherent beauty of thread and cloth, and the separation of which is the object of bleaching. He accordingly immersed a piece of unbleached cloth for some time in a solution of chlorine in water, and was extremely gratified to find it come out of a pure white colour. But his mortification was proportionally great on perceiving that cloth so bleached, after a certain time, gradually assumed a dingy yellow colour;—an alteration which he found greatly accelerated by treating the cloth with an alkaline ley. Harassed by this impediment, which threatened to take away all permanent benefit from his discovery, he began, however, to conceive that there is a strong analogy between the action of his chlorine upon the cloth and that of the ordinary process of bleaching, by subjection to light, air, and the moisture of a meadow exposure. He next considered that as the effect of this latter process is not a bleaching of the cloth, but merely such a loosening of the colouring matters as facilitates their final disengagement by some subsequent process, the same result might follow a similar aid given to the bleaching by chlorine. He accordingly conjoined the action of an alkaline ley with the immersion in chlorine, and by subjecting the cloth to these two processes for several times in alternate succession, he was happy enough to succeed in rendering it permanently white. The bleaching was rendered still more perfect by adding the customary finish of the process, a steeping in dilute sulphuric acid, or in very sour buttermilk.

Unhappily for France, she laboured at that time under a system of financial disorder accompanied by a heavy taxation, of which that

of the gabelle, or tax on salt, was one of the most unequal and of the most severe. And as all the chlorine was extracted from this article, she was unable at once to avail herself of the full benefits which immediately accrued to Britain from this discovery. Besides, the arts had then made comparatively small progress with her; and ignorance, ever hostile to improvement as an innovation, hindered for some time the general diffusion of the new process. Its inherent superiority was, however, too manifest to be slighted by prejudice, and too great to be destroyed by the more formidable obstacle of taxation. It was soon introduced and practised to a large extent by many intelligent bleachers, who did not follow their business as a mere routine. M. Caillau at St. Quentin, Déscroisilles at Rouen, Bonjour at Valenciennes, and Welter at Lille, all men of considerable eminence, who could join science with art, introduced the benefits of the new system into various parts of the empire.

But there are many other processes in the arts besides that of the simple bleaching of dingy cloth, in which the removal of certain colouring matters is advantageous, and which were of course susceptible of great improvement from the application of Berthollet's discovery. One of the earliest and most important of these was first suggested by our chemist himself: it relates to that process in calico-printing which is technically known by the appellation of *brightening*. When a piece of calico is dyed with madder, the portions meant to be preserved white are found to have contracted a dull red coloured stain; because, although colouring matters in general cannot form a permanent union with cloth except through the intervention of some mordant, they have often an immediate affinity for the cloth of such strength, as requires considerable labour for their complete removal. The old process for removing such discoloration was to boil the cloth in a mixture of bran and water, and then to expose it to the action of air and moisture for a period of from one to six, or even eight weeks together. This was generally a successful, but always a most tedious, operose and costly system. But the delay, the labour, and the expense, were very greatly reduced by M. Berthollet discovering that a very dilute solution of chlorine destroys colouring matters which are attached to the cloth only by their immediate affinity, while it produces no material alteration on such as are held in combination with it through the agency of a mordant. The new process of brightening by chlorine was of course immediately and universally adopted in all the calico print fields in France, and has now become part of the ordinary routine of that business.

But we are still far from having enumerated even the principal uses to which the bleaching property of chlorine was found applicable. By means of it, Berthollet was enabled to instruct his countrymen in an expeditious and, at the same time, a most accurate method of ascertaining the relative permanency of colouring matters when in combination with cloth. By means of it, Descroisilles brightened turkey red, by destroying the brown colouring matter which contaminates and conceals the beauty of that dye: by means of it, M. le Baron de Born gave a beautiful white to the yellow colour of animal wax, while Berthollet destroyed the green colour of vegetable wax, and gave it the closest resemblance to the bleached wax of de Born: by means of it, M. Chaptal succeeded in removing the stains from old books and prints: by means of it, Loysel bleached coloured rags for the manufacture of paper; and to cut short a list which might be extended to a tedious length, M. Berthollet, by means of chlorine, introduced the important improvement of giving to lint and to flax all the appearance of cotton.

It would indeed be difficult to mention any one course of investigation which led to so many, so

great, and so immediate benefits, as that into the nature and properties of chlorine, instituted and conducted by Berthollet. It often happens that the author of an important discovery does not live to see it appreciated, and himself acknowledged the benefactor of his species; but in this case our chemist had the felicity to enjoy the sight of the advantages he had conferred, and even to have many distinguished rivals competing with him in exploring the various uses of which his discoveries were susceptible. Nor should the biographer of Berthollet omit to mention that, notwithstanding his being thus the source of great wealth to his country and to England, he constantly declined to accept of any emolument even from those whose riches had never been amassed but for his researches. All the remuneration that he would receive in return for his benefits was the simple present of a bale of cloth from England, bleached according to his system. Who the merchant was who devised a present at once so delicate and so acceptable, is not now with any certainty known. But it seems fair to conjecture, that it was probably made through the intervention of Berthollet's much esteemed friend Mr. Watt, the first Englishman to whom the process was imparted, and of whom it was as worthy to bestow such a compliment as it was of the French chemist to receive it. Indeed, if ever man loved science for her own sake with a pure and sacred ardour, that man was Berthollet; and he was fortunate in this instance in receiving not only a reward such as no money or power could purchase, but also an immortality such as few men of genius feel assured of. By the universal assent of the French nation, the name of the inventor was adopted into the language to designate the new process. The bleaching liquor was styled *lessive de Berthollet*, or *berthollet;* to bleach by means of it was expressed by the verb *bertholler;* the bleachers were named *bertholleurs;* and *berthollerie, blanchisserie berthollienne, berthollimètre*, were successively adopted to express ideas which a knowledge of the root will at once convey. It is somewhat odd, Descroisilles observes, to find the name of one of the founders of the French *methodical* nomenclature introduced without ceremony to form the basis of a whole class of words, in utter contempt of all its principles.

The nature of the advantages thus introduced was truly surprising. Persons acquainted only with the modern mode of bleaching are astonished when they are informed, that what is now the work of a few days, was formerly the work of a whole summer; that what is now done almost within doors, formerly required extensive tracts of meadow ground at present under the plough; and, finally, that what is now undertaken and accomplished at all periods of the year, was then attempted during only half the year, the wintry period being wholly incompatible with the old process. Nay, in this country the inconveniences relieved by the new system were peculiarly great; for it was by no means uncommon at one time, to be at the expense of sending goods all the way to Holland to be subjected to a bleaching process there, whence they only returned after a heavy outlay, at soonest at the expiration of three or four months. The saving of time and of expense to the individual,—the redeeming of so much land to the country,—and in general the activity which has been given to the rapid circulation of capital in the community, have altogether been a source of incalculable benefit to the commerce of England, and to the general comfort of mankind. How happy the man of pure disinterested mind, who lived to see himself the author of so many blessings!

(*To be continued.*)

DICTIONARY OF CHEMISTRY.

GADOLINITE. A black mineral, consisting of silica 25.8, yttria 45. oxide of cerium 16.69, oxide of

iron 10.26, and loss 0.60. It is named after Professor Gadolin, who first noticed and described it.

Gahnite is another mineral, and so named after Gahn, the celebrated chemist.

Galbanum. A mixture of gum and resin, which exudes from the *bubon galbanum* in tears or drops, of a white, yellowish, or brownish colour. It is a bitter, acrid, disagreeable substance, with a very strong smell, having some resemblance to asafœtida.

Galena. A native *sulphuret of lead.* It is the principal source of all the lead used, containing about 66 parts in the 100 pure metal. It is found in various parts both of the old and new world.

Galibi. The name given to the human skeletons found at Guadaloupe.

Gall of Animals, *bile.*

Gall-stones, *biliary calculi.*

Gall of Glass, *glass gall, sandives.* The salt skimmed off the surface of glass while in fusion.

Gallates. Compounds of gallic acid and bases; some of them, as the *tannogallate* of iron, are of importance, as constituting the basis of writing ink and of black dyes.

Gallate of Cinchonina has been formed by dropping a tincture of galls into an infusion of pale bark.

Gallic Acid is obtained from gall-nuts, by bruising them, moistening them, and exposing them for some weeks to the temperature of 80°. The mouldy paste which forms, on being squeezed dry and digested in boiling water, gives a solution of gallic acid. It is composed of hydrogen 5.00, carbon 56.64, oxygen 38.36.

Galls, *gall-nuts, berry-galls, apple-galls.* The best are the nut-galls of the oak; and those brought from Aleppo to this country are preferred to all others. They are all protuberances produced by the puncture of an insect on plants and trees. The nut-galls are hard; *apple* and *berry-galls* soft and spongy. They consist, according to Sir H. Davy's experiments, of tannin, mucilage, gallic acid, extractive matter, calcareous earth, and saline matter. They are much used for making inks, black dyes, and in medicine.

Galvanic Apparatus, *galvanic battery, galvanic pile.* The name given to the alternate layers of pieces of metal and cloth which, by their contact, produce *Galvanic* or *Voltaic* electricity. The *battery* consists of more than one such pile.

Galvanic Circle is formed by uniting, by means of some conducting substance, the opposite ends of a Galvanic battery or pile, by which the electricity is annihilated or discharged.

Galvanism, *Voltaic electricity, Galvanic electricity.* The name given to the phenomena excited or produced by the Galvanic apparatus.

Gamboge, *cambogium, gambogium.* The produce of two trees, called by the Indians *caracapulli.* It is a vegetable juice, which concretes on exuding, and is a mixture of gum and resin. It is used in medicine as a purgative, and in the arts as a pigment, but it is not a very permanent colour. It is soluble both in water and alcohol. What we use in this country comes from *Cambaja* in the East Indies; and from the place of its origin all its names have been derived.

TO GILD MANUSCRIPT WRITING.

Dissolve a little gum ammoniac in a small quantity of water, in which a little gum arabic and the juice of garlic has been previously dissolved. Write with this liquid instead of ink, or form characters with it, by means of a camel's hair pencil. Let the characters dry, then breathe upon them, and apply leaves of gold to them, as for any other kind of gilding. The superfluous gold may be removed by a brush, the writing will then appear covered with gold, and may be burnished.

M. FOURIER ON THE HEAT OF THE GLOBE.

We quoted in our Journal the week before last a praiseworthy example of a man of science in France condescending to turn his attention to

the common arts of life, though his labours were directed to a no higher object than making good blacking. We shall now give our readers a specimen of the *uncommon*, but, alas! too frequent scientific abstractions which absorb the attention of most of the members of learned societies. These *un*common abstractions, be it remembered, are what they particularly pride themselves on, as distinguishing them from the common herd of men, and exalting them above the *vulgar* pursuits of every-day life. If we can find in these abstractions any just grounds of ridicule, surely the mere name of *science* which is bestowed on them,—the pedantry of an infinitesmal calculus and of algebraic solutions, by which their utter worthlessness is hidden,—ought not to shield them from public contempt. The most essential part of knowledge, but the most neglected, is that which informs us of the relative value of different studies and pursuits. In science, unfortunately, chance, rather than wise deliberation has directed the researches of men, just as caprice or fashion, and not reason, has prescribed social institutions. Much of what we now find in both enjoys a sort of traditionary homage, though it originated in the filthy idleness of a cloister, or in the rude ambition of ignorant barbarians, and has no other claim to our reverence than its continued existence. But for some of the occasional aberrations of learned men into the regions of fancy or absurdity, the book of science might be too dull to interest us; and we ought, perhaps, to be as thankful to them when they excite our imagination or stir up our spleen, as when they impart to us solid instruction. It is on this account that we are equally grateful to M. Fourier for his *morceau* of nonsense as we were to M. Braconnot for his item of information which has a tendency to usefulness.

M. Fourier is, we believe, one of the *perpetual* secretaries to the scientific department of the Royal Academy of France (the Institute, as it was called); and he has lately published an elaborate paper in the *Annales de Chimie et de Physique*, under the title of 'General Remarks on the Temperatures of the Terrestrial Globe and of Planetary Spaces.' In this paper, which is mathematical throughout, and has every part except the principles demonstrated, the following axioms are laid down:—1st, "The earth is heated by the solar rays, the unequal distribution of which produces the diversity of climates." This is so novel and so true, that it required to be enunciated with all the precision of a geometrical first principle; and M. Fourier certainly deserves praise for carrying the light of logic into so abstruse a subject. 2dly, "The earth shares in the temperature common to planetary space, being exposed to the irradiation of the innumerable stars which surround the solar system at all points." This is both new light to us, and new heat, we believe, to the rest of the world. How delightful of a cold clear *frosty* night, to bask in the caloric emitted by the twinklers over head. We have only to collect their rays in a reflector, such as is described by Mr. Corbet in our 47th Number, and we shall have a sun by night and a tropical heat in the depth of winter. We regret, for the honour of M. Fourier's discovery, that the season is so very mild and the stars are so seldom seen.

The third position, however, of this right learned man is the most important and the most comfortable. It is as follows:—"The earth has preserved in the interior of its substance *a part of the primitive heat which it contained when the planets were formed.*" This position we take to be a proof of the *infinite* nature of the human understanding. Here is a light hop-skip-and-jump Frenchman finds out, by definition, that the earth originally contained heat when it was made, for we presume it is included amongst the planets; and that its temperature at present is owing to a part of this heat, which it has preserved till now. We have no doubt that

M. Fourier has arrived at this curious piece of information by a close attention to the degrees of heat evolved by degrees of condensation. He has fully ascertained, we suppose, the nature of the different elementary matters which form the whole contents of the globe, and has calculated to a fraction the heat they would evolve when first mingled and condensed.

The consequences, however, which this learned man draws from his positions are still more extraordinary. We are told first, that our solar system is placed in a region of the universe, of which all the points have a common and constant temperature determined by the rays of light and heat emittted by all the surrounding stars. This is so general and mathematical a deduction, that of course it excludes that naughty place for the punishment of the wicked, of which so much is said to children. M. Fourier, who has lived through the revolution, and probably imbibed its doctrines, takes this covert mode, while he regularly attends mass like a good Catholic, to diminish or check the growing influence of the priesthood in France, by proving that the punishment with which they threaten sinners cannot exist. Those who fear cold, however, may find as secure a source of torment in every part of the universe as in any imagined degree of heat. M. Fourier next informs us, that the cold temperature of the planetary heaven is but little inferior to that of the polar regions of the globe. Indeed, we should all be exposed to the same cold, he says, as that of the planetary heavens, if the earth were not warmed by two other concurring causes: viz. the interior heat, and the action of the sun's rays, as laid down in his first and third positions. "The interior heat," however, "causes no sensible effect on the surface of the globe;" so that we are no warmer on account of it, but "it may be immense in the centre of the earth." The temperature of the surface does not exceed, by the thirtieth part of a centesimal degree, the extreme point to which it will come. At first it diminished very rapidly; but in its present state the change goes on with extreme slowness. "A great number of ages (he adds) must have passed, before the interior heat of the globe passed off to its present state." Having now shown the reader how very easy it is to tell all about the primitive interior heat of the globe, and the ratio of its dissipation, we shall leave him to wonder at and admire the profound skill of M. Fourier. Perhaps we shall hereafter translate some more passages of this very learned man's most learned paper.

SLOW PROGRESS OF PRACTICAL SCIENCE.

It has hitherto very frequently happened, that noble discoveries, when once made, have been lost to the world for centuries. The principal reason of this has been, the separation of European society into two great classes, the learned and the unlearned. The latter were much more numerous than the former. Of the former, also, a great many were blinded by too much learning of some particular species, so that, in fact, the number of minds capable of appreciating, applying, continuing, and improving the discoveries of a man of genius, has been, at former periods, amazingly small. Hence many of them have been neglected, and many lost. This state of things is fortunately now much better; and there are not only more discoveries in the world than ever before existed, but a much greater proportion of minds capable of appreciating discoveries. As education is extended, improvement goes on in a compound ratio, and nothing is lost. As an instance of loss of discoveries, we mean to quote the fact of Glauber having observed that vinegar could be obtained from wood. This illustrious chemist, of whom it is observed by Mr. Brande, "Had he lived in a more propitious age,"—meaning an age when science was farther advanced, and education more widely diffused,—

"he would have rivalled the eminence of Scheele and of Priestley,"—flourished in the middle of the 17th century, and then described at length a means of extracting vinegar from wood. He mentions also the tar or oil, which he says is an admirable preservative of wood. At that time he was apprehensive what he wrote would not be believed; "but it contenteth me," he said, "that I have written the truth, and lighted a candle to my neighbours." Judging from the results, it would appear that he was not believed. His discovery was not acted on extensively till the beginning of the present century. That it was not unimportant, is proved by the numerous applications to which pyrolignous acid is put. To mention but one:—All the sugar of lead of commerce, of which there is a very considerable consumption, not only on its own account, but as being the best means of obtaining the *acetates* of iron and alumina, both being indispensable to the dyer, was formerly made only in wine countries, and imported thence to England. This substance is now manufactured at home; so that this discovery of Glauber's, after lying in oblivion for a century and a half, has, on being again discovered and brought into practice, contributed to the prosperity of Britain, and had no inconsiderable effects on the trade of Europe.

CURE FOR WORMS.

To the Editor of The Chemist.

Mr. Editor,—In an early Number of the New Monthly Magazine I find the following recipe for the destruction of those extremely troublesome and disagreeable worms called "Ascarides," which infest the lower intestines and rectum:—

"Pour red port wine into a pewter dish, and let it stand 24 hours; half a common wine-glass is a sufficient dose for an infant, and a whole one for an adult."

Now, Sir, as I am somewhat doubtful whether a poisonous ingredient, as arsenic, may not be taken up into the wine during the 24 hours, and whether, during the destruction of the worms, the alimentary canal may not be injured by the mixture, perhaps some of your scientific readers will inform me how far I may take the medicine with safety.

I remain, Sir,
Your constant reader,
Feb. 1825. Amphibolos.*

* "Amphibolos" need be under no apprehension, we believe, though we are rather afraid he will not find the medicine very efficacious.

TO CORRESPONDENTS.

"Quæsitor" is informed, that by mixing one part of sal ammoniac with two parts of powdered quick lime in a retort, and applying the heat of a spirit lamp, he will decompose the sal ammoniac, or muriate of ammonia. The ammonia will be liberated in the shape of gas, which must be collected over mercury, and muriate of lime will remain in the retort. The muriatic acid may be separated from this by sulphuric acid; and we refer him to The Chemist, vol. i. pp. 184, 252, to see how the two elements of muriate of ammonia may be recomposed. At the same time we must observe, in consequence of the facility with which both the elements are obtained from other sources, this mode of decomposing the sal ammoniac is seldom had recourse to, and is by no means the easiest method either of procuring muriatic acid, or ammonia, or showing the formation of the salt.

We know nothing of the crucibles alluded to by an "Old Friend." His other requests we have been unable this week to attend to: but they shall not be forgotten.

The letter of "E. H." is quite inadmissible.

The answer to John Williams is so obvious, that we do not think it necessary to insert his question. Quinine, according to all present opinions, exists ready formed in the yellow bark.

"Edward" and "A Subscriber" have been received. We will procure or supply the former with the information he asks.

We should suppose the experiment mentioned by "Tyro" is not practicable. It is with considerable difficulty that water is frozen in the receiver of an air-pump, and to freeze mercury the difficulty must be much greater, if not insurmountable.

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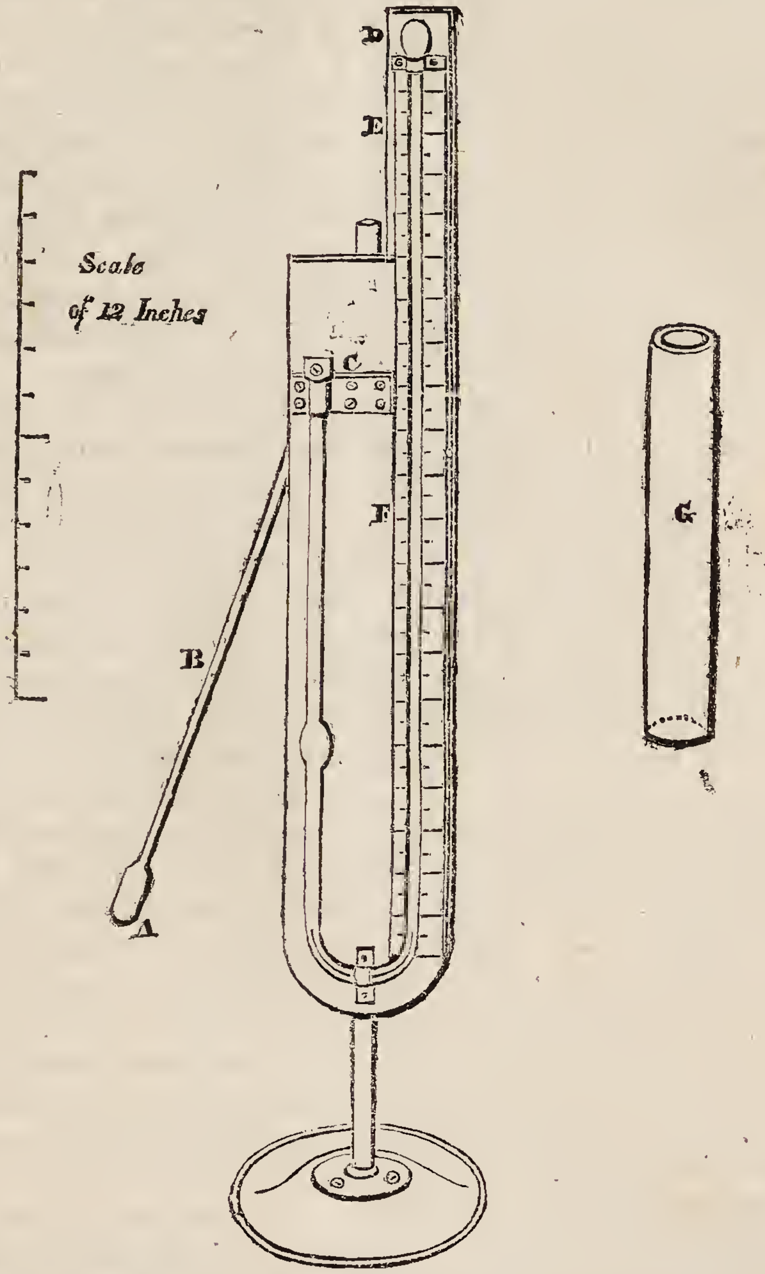

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MILL'S PYROMETER.

Mr. Children very justly observes, in a note in his excellent Translation of Thenard's Analysis, "We have no means of accurately measuring intense heats. The philosopher who should invent such an instrument would confer an essential obligation on the science of chemistry in general, as well as on

many of the arts and manufactures; at present, the eye of experience is the only pyrometer the operator can rely on."

The changes that take place in the composition of bodies, by the mere application of heat, are very well known, and it is because no means have hitherto existed of measuring high temperatures, that compounds have been formed which could never afterwards be reformed.

A very familiar instance of the changes effected by a difference of temperature is fermentation. Thus, if sugar and water be mixed together in certain proportions, and yeast be added, at the temperature of 50 degrees of Fahrenheit, no change will ensue; if the temperature be gradually raised to 55°, and increased to 70°, spirit will be generated; if the heat be still further increased, from 70° to 90°, acetic acid, or vinegar, will be produced; and again, if the temperature be increased to 150° Fahrenheit, all fermentation will be destroyed, and no change will be effected whatever.

From analogy it is but fair to suppose that similar changes may be effected in different, or even in the same body, by increment of heat in higher temperatures; therefore, the invention of an instrument susceptible of such accuracy as this carries upon the face of it, may be hailed as an important improvement in chemistry, the arts and manufactures, where heat is used in the process.

Sugar refiners, distillers, oil refiners, and metallurgists in general, will doubtless be much benefitted by its use.

Description of the Instrument.—The metallic bulb and stem A B is composed of platinum, and is drawn down without any joint.

The bulb is hollow, and its diameter is about half an inch internally, or less, according to the size of the instrument. The bore of the tube B is perfectly cylindrical, and about 1-16th of an inch internal diameter; at the further end of this tube is attached, by an air-tight joint, a glass tube C, which is bent in a triangular form. At the extremity of this tube is a bulb of glass D, of the same capacity as the platinum bulb A, with a funnel-shaped mouth, for the insertion of the mercury, which is afterwards hermetically sealed. The scale E is attached to the perpendicular glass stem F, and is graduated like a thermometer.

Heat applied to the platinum bulb expands the atmospheric air which it contains, and its pressure against the mercury repels it up the glass tube F, to which the scale is attached. As the heat is increased so does the air expand, and the scale indicates the degree of temperature.

The principle upon which this instrument is constructed is, that gases augment in volume in a progressive ratio, their expansion with increment of heat being uniform. No other known body possesses this quality so truly as gas, therefore this pyrometer is an instrument susceptible of very considerable accuracy.

In its use some precaution is necessary; because, if the platinum bulb were plunged into the naked fire, it would be corroded and destroyed; a crucible of the form G is therefore necessary, which is made of the most refractory clay; the platinum bulb, and part of the stem, is to be placed in it, and the empty part filled up with pounded charcoal or sand.

The extensive use to which this pyrometer may be applied in the arts and manufactures, is at one view obvious.

The degree of heat of any furnace, kiln, or boiler, may be read off by the scale, at a single glance, at every and any part of the process, and thereby certainty in the result insured.

LECTURES AT THE ROYAL INSTITUTION.

COMPOUNDS OF PHOSPHORUS. CARBON.

Lecture 24. Phosphorus and oxygen combine to form two acids, and perhaps three. The two acids,

with which we are well acquainted, are the phosphorous and the phosphoric; the former is a compound of one proportional phosphorus, 12, and one proportional oxygen, 8, its equivalent being 20. The latter is a compound of one proportional phosphorus, 12, and two proportionals of oxygen, 16, its equivalent being 28. The third compound has been called hypophosphorous acid, and it has been supposed that it exists in combination with barium, forming salts with that base; but I shall postpone, said Mr. Brande, the consideration of this compound of phosphorus with oxygen till we come to treat of the salts of barium. At present, then, our attention is to be directed only to the two compounds, phosphorous and phosphoric acids.

Chlorine and phosphorus unite in the ratio one proportional of each to form chloride of phosphorus; and when this is exposed to the action of water, we find that muriatic acid and phosphorous acid are formed, the latter of which may be obtained by filtering and evaporating the solution. It is a white crystallized body, of a sour taste, and very soluble. In general it is combined with water. and has therefore been called hydrophosphorous acid. It is of no importance in itself, but is worthy of notice as one of the definite combinations of phosphorus with oxygen.

Phosphoric acid is of much more importance, for, in combination with lime, it exists in all animals, constituting the earthy part of their bones: and being also found in many of the animal secretions. It is readily obtained by burning phosphorus in oxygen gas, or in atmospheric air, or by dropping phosphorus into heated nitric acid. Mr. Brande first of all burnt some phosphorus in oxygen gas, and afterwards in atmospheric air, inclosed within a tall glass vessel; in the latter case, the product, consisting of a white flaky substance, was collected on a piece of glass, placed under the vessel. It is extremely deliquescent, combining eagerly with water, and producing a considerable degree of heat during the combination. When this acid is fused it is called glacial phosphoric acid. As it is generally found combined with water, it has a specific gravity of 2, water being 1. When phosphorus is burnt in the air, phosphoric acid is generally mixed with phosphorous acid; but this latter may be got rid of by the application of heat. Phosphoric acid in a very pure state may also be obtained from phosphate of ammonia. This salt exists in animal fluids, and is a compound of one proportional phosphoric acid, 28, and one proportional ammonia, 17=45. By exposing the salt to heat we obtain impure phosphoric acid, which being dissolved and crystallized, separates from the impurities.

Chlorine and phosphorus act on each other with great intensity, and we are acquainted with two compounds which they form—the chloride and the perchloride of phosphorus. Phosphorus catches fire the instant it comes into contact with chlorine, burns with a pale flame, and forms perchloride of phosphorus. The chloride or protochloride is formed by distilling a mixture of phosphorus and corrosive sublimate, which is a perchloride of mercury. The phosphorus abstracts one proportional of chlorine, and the protochlorides of mercury and of phosphorus result. The protochloride, when exposed to moisture, is decomposed, muriatic and phosphoric acids are formed, the latter of which may be obtained quite pure. The clorides of phosphorus are of no other importance than as a fine illustration of the doctrine of equivalents or proportionals.

Iodine and phosphorus also act violently on each other, the resulting compound being iodide of phosphorus. It decomposes water very rapidly, and produces phosphoric and hydriodic acids.

Hydrogen and phosphorus have hardly any action on each other, unless they are brought into contact when hydrogen is in its nascent state, and then two compounds are

formed, which are called phosphuretted hydrogen and hydroguret of phosphorus. The former is obtained by heating phosphorus in a solution of caustic potassa, when a gas is given out which catches fire the instant it comes into contact with the atmosphere. It is a colourless gas, has a nauseous smell like that of onions, and a bitter taste. On being kept for some time it deposits phosphorus, and dees not catch fire so readily on coming into contact with the air. Mr. Brande had some of this gas, which he said had been prepared two or three days, but it caught fire the instant the phials containing it were uncorked. On uncorking one of the phials under water, the gas burst into a flame on reaching the surface. The gas loses this property of inflaming if kept over water. It inflames still more brilliantly in oxygen gas, and burns with a beautiful pale light in chlorine, forming muriatic acid. It is a compound of one proportional phosphorus, 12, and one proportional of hydrogen, 1, its equivalent being 13, and hydrogen suffering no alteration in volume. It is decomposed by sulphur, phosphorus is deposited, and sulphuretted hydrogen is formed.

Hydrophosphoric gas, or bihydroguret of phosphorus, is another compound of phosphorus and hydrogen; it is of no importance, except being in a scientific point of view a good illustration of the doctrine of proportionals.

Phosphorus and nitrogen produce no definite compound, and seem to have no action on each other; but in some of the products of animal decomposition nitrogen appears to hold phosphorus in solution. Sulphur and phosphorus combine when fused together in an exhausted vessel, and form a compound of no importance, which may be called either phosphuretted sulphur, or sulphuretted phosphorus, at pleasure. In concluding his observations on both phosphorus and sulphur, Mr. Brande remarked, whenever either of these bodies was acted on in a state of fusion by the Voltaic spark, that hydrogen gas was produced, though neither of these bodies is otherwise altered. From this circumstance, it has been inferred that both phosphorus and sulphur are compounds; there is no other proof of this, but it is an hypothesis which may be defended, were it worth while. In the present state of our knowledge, however, till further proof of the contrary is advanced, it will be better to consider, as we have done, phosphorus and sulphur as simple bodies. Of the next two elementary bodies which are to engage our attention, one of them, Carbon, is of very considerable, and the other, Boron, of very minor importance.

Carbon, the first of these, exists in its purest form in the diamond, which need not be described as a most beautiful gem. It is a crystallized body, the form of its primitive crystals being that of a regular octöedron. Sometimes each triangular *facet* of the octöedron is replaced by six secondary triangles, bounded by curved lines, so that the crystal assumes a spheroidal shape. This gem was first found in Asia, and for a long time all the diamonds brought to Europe came from that country. In the year 1720, however, diamonds were discovered in the Brazils, and since that time Europe has been partly supplied from America. Diamonds have been found quite colourless, and also of different shades. Those which are colourless are more valuable than the others, and after the colourless, those are preferred which have a decided tint of red, blue, or green. Black diamonds are extremely rare, but two having a black appearance, though in reality of a deep smoke colour, are known, and highly esteemed. Diamonds have always been found in an alluvial gravelly soil, washed down from the spot where they have originally existed, so that the *site* of their formation is not correctly known. The specific gravity of diamond is 3.5, water being 1.

CUTTING OF DIAMONDS.

For a long time, at least in Eu-

rope, the art of cutting diamonds remained undiscovered, and they were always worn rough as they were found. The diamond is so hard that no means were then known of altering its shape. In 1456 a Dutchman, Louis Bergher, of Bruges, accidentally discovered that by rubbing two diamonds together, a new facet might be given to them. Since then diamonds have been cut and polished, and their beauty much increased. There are two forms into which they are cut, and which are distinguished by the names of rose diamonds and brilliants. By either method, but more particularly by the latter, so much of the gem is cut away that it does not weigh above the half of its weight when rough; and therefore the price of a cut diamond, as to a rough one, in proportion to the weight of each, is always double. The weight of diamonds is estimated in carats, 150 of which are equal to one ounce troy.* The average price of rough diamonds is about 2*l.* per carat, and the difference in their price is, generally speaking, as the squares of their respective weights. According to this scale, a wrought diamond, 3 carats, is worth 72*l.*, and one of 100 carats, 80,000*l.*

The largest diamond probably ever heard of, is one mentioned by Tavernier, who saw it in the possession of the Great Mogul. It was about as big as a hen's egg, and weighed 900 carats in the rough. It was cut in the rose form, and was found in Golconda, about 1550. The largest diamond ever brought to Europe is one now in the possession of the sovereign of Russia. It weighs 195 carats, and was long employed as the eye of a braminical idol. A French soldier discovered the value of the gem, and changed his religion, worshipping at the altar of the barbarous god, that he might deprive him of his splendid eye. At length he succeeded in substituting a piece of glass for the diamond, and again became a christian. He had some difficulty in disposing of his plunder, and at length got for it only an inconsiderable sum. It was so large that nobody was able to purchase it. After passing through several hands, the Empress Catherine at length fixed it in the possession of the Russian crown, giving for it the sum of 90,000*l.* and a perpetual annuity of 1000*l.* This is not a handsome gem, comparatively. It is cut in the rose form, and is of the size of a pigeon's egg.

One of the most beautiful diamonds ever seen is the Pitt diamond, which is a brilliant, and weighs rather more than 136 carats. It was brought from India by a gentleman of the name of Pitt, and purchased by the Duke of Orleans, then Regent of France, who placed it in the crown of France, where it still remains. The celebrated Pigot diamond is now in London, in the possession of Messrs. Rundell and Bridges.

Another form of charcoal is obtained from burning wood; and the purest form of this, that which is used by the gunpowder manufacturers, is procured by distilling the wood in close vessels, vinegar being obtained from the distillation. Young wood gives a better charcoal than old wood or timber, though it is the same substance from whatever wood obtained.—Lamp-black is another form of charcoal, and is prepared by burning the refuse resin of turpentine manufacturers; the dense smoke from the combustible being collected in chambers hung round with sacking, on which the soot is deposited, and occasionally swept off and collected. After this has been heated in close vessels it may be considered as pure carbon. Ivory-black, another form of carbon, but not so pure, is obtained from burning bones.

Charcoal is a black, insoluble, inodorous, brittle substance, and

* It is said, the price of diamonds is so great, the smallest difference in weight making a difference in price, that diamond merchants consult the barometer in their dealings; and like to sell only when the pressure is diminished, and buy when it is increased.

possesses the singular property of destroying the smell and taste of a variety of animal and vegetable substances. It is therefore used to get rid of the bad smell and taste of meat, and of water beginning to putrefy; and it is on this principle that filtering machines in which charcoal is used are so advantageous. According to some experiments of M. Bussy, this effect of charcoal appears to be owing rather to some mechanical than chemical properties of the charcoal employed.

Charcoal absorbs different gases in different proportions: of ammoniacal gas it absorbs 90 times its volume; of muriatic acid, 85 times; sulphurous acid, 65; sulphuretted hydrogen, 55; nitrous oxide, 40; carbonic acid, 35; oxygen, 9.14; hydrogen, only 1.314. The absorption is complete in 24 hours. This property seems also to depend on the mechanical texture of the charcoal, and varies as the charcoal is obtained from different woods. Messrs. Allen and Pepys found that, by a week's exposure, the charcoal of lignum vitæ gained 9.6 per cent.; fir, 13; box, 14; beech, 16.3; oak, 16.5; mahogany, 18. The substance absorbed was aqueous vapour, which new made charcoal takes up rapidly. The compounds of carbon will be considered in the next lecture.

DICTIONARY OF CHEMISTRY.

Gangue. The mineral which fills up the cavities or veins in which metals are found, and which surrounds and incloses them, is called their gangue by mineralogists. It is looked on as the matrix of the ore.

Garnet. A well-known beautiful mineral. Mineralogists include under this term several species of minerals. The precious, or noble garnet is composed of 39.66 silica, 19.66 alumina, 39 68 black oxide of iron, 1.80 manganese. It is found in many places in the north of Europe. Coarse garnets are used as emery.

Garnet, Resinous, *colophonite.*

Garnet-Blende, *zinc blende.* A sulphuret of zinc.

Gas. The name given to every aërial fluid which exists in a permanently elastic form, except the atmosphere, to which the term "air" is applied. Aërial fluids, which are not permanently elastic, are usually called vapours.

Gasometer. An instrument for holding and measuring gases.

Gastric Juice. A juice secreted by the glands placed between the membranes which line the stomach, and transmitted from them into the stomach. It is the solvent or digester of our food. Its constituent parts are not accurately known.

Gehlenite. A mineral found in the Tyrol, and consisting of lime 35.5, silica 29.64, alumina 24.8, oxide of iron 6.56, volatile matter 3.3.

Gelatine, *jelly.* An animal substance soluble in water. At common temperatures it assumes a tremulous consistence, and may be liquefied by increasing the temperature: this distinguishes it from albumen, which is coagulable, or becomes solid by heat. By tannin it is precipitated insoluble, and it is this action of the tannin on gelatine out of which skins and hides are principally formed, which is the foundation of the art of making leather. Gelatine consists of 47.88 carbon, oxygen 27.21, hydrogen 7 91, nitrogen 16.99.

Gems. Precious stones. The *diamond, ruby, sapphire, topaz, chrysolite, beryl, emerald, hyacinth, amethyst, garnet, tourmalin, opal, rock crystal, cat's-eye, oculus mundi, chalcedony, moon-stone, onyx, cornelian, sardonyx, agate, Labrador-stone,* and the finer kinds of *flint pebbles,* are all classed as precious stones. Their composition will be found under the different heads.

Gentian. The root of the *gentiana lutea.* It consists principally of resin and gum, with extractive and colouring matter, and a peculiar oil.

Geognosy. Geology. That part of science which describes the structure of the earth, as to the materials of which it is composed

and the order in which they are arranged. As far as it teaches what may be learnt by observation, namely, the relative positions of the different great masses of rock of which the earth is composed, it is very useful; but when it attempts to ascertain the cause of the formations observed, as it then goes out of the period of the existence of our race, it seems only to be mere hypothesis—amusing, perhaps, to those who like to let their imaginations work at a small expense of facts, but of no use either in its principles or its conclusions. There is probably few subjects on which there have been more absurd hypotheses advanced. At present there are only two in vogue, that of Werner, which asscribes the formations on the crust of the globe to be deposits from some fluid; and that of Hutton, which supposes the rocks to have been formed by fusion. It is probable both are partly right; at least, while there is strong evidence, as in the present existence of numerous volcanoes, and in the obviously fused nature of many substances, for fire having played a part in it; and while there is such strong evidence as the shells of various fishes deposited in different strata of the earth, for water having had, at some time, a share in producing the phenomena, it is not right to attribute them all to either cause. At the same time, it seems impossible to ascertain at what time and in what way, whether at once or at successive and distant periods, both causes combined to produce the effects which we can now trace. There are, however, many curious facts connected with this science, on which modern chemistry has thrown much light.

PROPELLING VESSELS BY GAS.

To the Editor of The Chemist.

Sir,—I shall be much obliged to you or any of your correspondents for remarks on the following subject: I think you will understand it without a drawing. I have a notion that vessels may be propelled by exploding gas. The means I would employ consists simply of two cylinders, fixed in a slanting direction, and made of a small diameter. They come into contact with the water at the bottom of the vessel, and the exploding of one charges the other. This is effected by two valves, to which a forcing pump is attached. They are fixed on a spindle, and work nearly at right angles. In the inside of the cylinders there are two valves to let in air, and two to prevent the water from flowing up the cylinders. The cylinders are divided by the two valves that are worked by the pump when the charge is given. The whole apparatus is so compact that any vessel might use it, and work it by powder, in case she was in danger, charging from the breach end of the cylinder.

I am, Sir,

Your obedient servant,

Newcastle-upon-Tyne, J. B.
Feb. 14.

P.S. I forgot to mention that the gas cylinders must be fixed in cases which contain water, to keep them cool.

WHAT WE EAT.

If a piece of the best beef be placed under the receiver of an air-pump, and a flat dish containing concentrated sulphuric acid be also placed under the receiver to assist in absorbing the moisture, and then the pump be worked, the beef will be found to lose about three-fourths of its weight; whence it is concluded, that the best beef contains about 74 per cent. of water. The most ardent lover of spirituous liquors probably, therefore, eats the milder fluid though he scorns to drink it. This circumstance, as it shows that what meat loses in weight when roasted is principally water, seems to indicate, that when thus prepared it may contain as much nutritious matter as if made into soup; we are sure then to have all its water, and some additional.

QUERIES.

To make a liquid, or other menstruum, that will effectually extract grease and other spots from woollens, silks, &c. without injuring the colour.

The way to make the reviver for black cloth, &c., known by the name of 'Dr. Wynn's Paris Black Reviver,' and retailed by most oilmen?

The best means of filtering different liquids, both corrosive and otherwise, with a description of the most approved apparatus.

TO MAKE ARTIFICIAL GEMS.

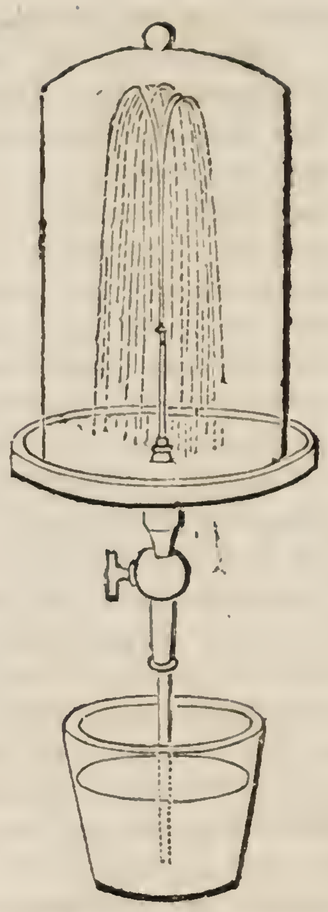
The paste, as it is called, may be made of—

	Grains.
Powdered rock crystal	4056
Red lead	6300
Pure potassa	2154
Borax	276
Arsenic	12

Or,

Litharge	100
White sand	75
White tartar of potash	10

These ingredients, mixed and perfectly fused, may be coloured like a ruby by the purple of Cassius; yellow, by oxide or phosphate of silver; green, yellow, and brown, by the oxides of iron; a rich green, by the oxides of copper; a red, if a small portion of tartar be mixed with these oxides. Antimony gives a rich yellow, and the black oxide of manganese gives various shades of purple, deepening into black. Cobalt imparts blues of different shades, and with antimony or lead it produces green. Fine greens and reds are given by chromium. These different ingredients may be added in any proportion; but a small quantity is sufficient to produce the colour required.

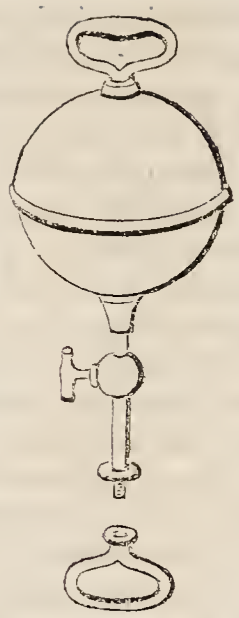


ANOTHER PARLOUR FOUNTAIN.

Procure a plate, either of wood or brass, with a hole at its upper surface, and a tube provided with a stop-cock descending from its lower surface, as seen in the plate. Screw the tube with the stop-cock into an air-pump, and place a tall glass jar on the plate; exhaust the air from the jar, and then turn the stop-cock to prevent its re-admission. Remove the apparatus from the pump, and place the lower end of the tube in a vessel of water; turn the stop-cock, and the pressure of the air on the surface of the water in the vessel will force it up into the jar in a beautiful stream, which will continue till the equilibrium of pressure is restored.

TO MAKE ARTIFICIAL GARNETS.

Take two ounces of the purest white glass, one ounce of glass of antimony, one grain of the powder of Cassius, and one grain of manganese. Reduce the materials to powder, mix them intimately together, and fuse them in a crucible: the result will be a stone or glass resembling garnet.



PRESSURE OF AIR.

The little figure subjoined is the representation of an instrument, frequently employed by lecturers on pneumatics to show the pressure of the air. It consists of two concave hemispheres of brass, which fit into each other. The lower end is screwed into the plate of an air-pump, the upper one is fitted into it, and the air exhausted from both the hemispheres; when this is the case, the stop cock is turned so that the air cannot gain admission, and they are removed from the plate. Under these circumstances an individual cannot pull them asunder as long as the air is excluded, but when it is admitted the separation is easy. Some of our readers, who may not have seen this experiment practised, may perhaps like to repeat it.

LIFE OF BERTHOLLET.

(*Continued from p.* 332.)

Almost every year in the life of Berthollet, after he had arrived at maturity, was productive of a discovery which was either beneficial in extending science, or in promoting some useful art.

In the year 1791, Berthollet conferred one of his most signal benefits upon his country by the publication of his work, entitled "Elements of the Art of Dyeing."—France in general, and the neighbourhood of Lyons and Rouen in particular, had long been celebrated for the assiduity and success with which the art of dyeing had been there cultivated. Ever since the days of Colbert it had been the practice in France to appoint one of her most eminent chemists to the peculiar superintendence of the processes of dyeing. After the death of Macquer, Berthollet succeeded to this office. Macquer, though he lived till 1784, had not assented to the new theory of Lavoisier, and had indeed, only in the last years of his life, employed some of its doctrines to an extent so partial, as rather to increase the perplexity of the old system than materially to remove it. Accordingly, the vacant situation had not long been occupied by Berthollet, when the revolution in chemistry, and the many important discoveries accompanying it, rendered every preceding work on dyeing defective in information, and to the modern dyer almost unintelligible in its explanations. These deficiencies were amply supplied, and the various processes of the art were ably explained according to the new philosophy of chemistry, by the publication of Berthollet's Elements of Dyeing in 1791. Thirteen years after this, another greatly enlarged edition of this work, embodying every improvement, was prepared by the joint labours of Berthollet and his son, A. B. Berthollet, then a young man of the fairest promise.

Among the other improvements which Berthollet introduced into the art of dyeing, there is one of so great importance, and at the same time involved in such difficulties, that it deserves particular notice. This is his mode of employing prussian blue in the formation of the brightest permanent blues and greens now in use.

The remarkable brilliancy of this substance as a colouring matter, early recommended it to the notice of chemists and practical dyers, all of whom, however, were baffled in their attempts to discover any means of fixing it in an equal and permanent manner upon cloth. Menon, Macquer, and Roland, successively assayed this task, and

each proposed a separate process for performing it; but in practice the same want of success attended the proposals of each. In some, only a very pale shade of colour was produced; in others, where the colour was at once deeper and moderately permanent, it was always found unequally distributed over the cloth; and in a third, the colour, which at first was bright and equable enough, was at the same time so fugitive, from its having been applied in a manner merely mechanical, that a slight wearing speedily injured it, and after a few washings it almost entirely disappeared.

The mode in which Berthollet overcame all these difficulties was a most ingenious one, and it was the result of much research and experiment on his part; in the course of which he was aided by the celebrated calico-printer Widmer. It occurred to Berthollet that, as prussian blue is a compound substance, of which one constituent by itself has a strong affinity for cloth, it might be possible that the other constituent would unite readily with the first, even on finding it previously combined with the cloth, although the compound body so presented refuses any such union. He therefore first treated cloth with oxide of iron, one constituent of prussian blue, for which the cloth has a powerful affinity, and next superinduced upon the whole the acid principle, by the application of an alkaline prussiate. The acid colouring matter, uniting with the oxide of iron, formed the dye, without at all disengaging the previous combination between the cloth and the oxide. The prussian blue communicated in this manner is found to have nearly as strong an affinity for cloth as the oxide of iron has when in separate combination with it; and thus, by the result of this method, a blue colour of the greatest brilliancy and permanency was added to the art of dyeing.

In employing the same substance as an ingredient to produce a green, M. Berthollet's ingenuity was again severely tried, and again it overcame every difficulty. To achieve this, there is one other step necessary in the series of affinities, which are all brought into play only by the *order* in which they are made to follow each other; a process which in the end produces a compound combination, refused to every other system. Green is a colour which the dyer invariably produces by the mixture of blue and yellow; but the prussian blue has *no affinity for cloth*, and when this obstacle is overcome, it has *no affinity for the yellow colouring matter;* neither has the yellow any direct affinity for the cloth; yet there must be a combination of these colours with *each other* and with *the cloth*, or there can be no use made of prussian blue in dyeing green. To effect this, the three constituents of the green colour were applied separately. First, the cloth was treated with oxide of iron, for which it has a great affinity: the next step was to add to this a yellow dyestuff, with which also the oxide has a tendency to combine; and, lastly, there was superinduced, above all, the prussic colouring matter. The result was, that the oxide of iron, once combined with the cloth, retained united to *itself* the *yellow* and the *acid colouring* matters, forming as the product a beautiful and lasting green. This process is now in universal practice among dyers and calico-printers; and however great the extent of its use, the pleasure of seeing it universally diffused was here also the sole return that ever was made to the author for his perseverance and ingenuity. Men, like Berthollet, sometimes confer benefits too great to be remunerated by any other than the rich reward of their country's gratitude.

After the commencement of the French revolution France was, by common consent, put under the ban of all the nations of civilized Europe. She was consequently cut off from all those supplies she had usually obtained from other countries. Although so warlike, she had been in the habit of im-

porting all her saltpetre. When this necessary article was denied her, and an instant invasion impended, the appalling demand of gunpowder, to the amount of twenty millions of pounds, was made as essential to her defence. In this crisis, a committee of the most eminent chemists was applied to, and the country soon received, as the result of their investigations, the delightful intelligence, that an inexhaustible supply of saltpetre, easily accessible, lay within the bosom of their native soil. "In five days," one of the committee boldly affirmed, "in five days after the saltpetre shall have been extracted from the earth, gunpowder manufactured from it shall charge your cannon:" and his words were verified to the letter!

It was then that the whole face of the country seemed for a time covered with manufactories of this substance. The citizens emulated each other in amassing and lixiviating the proper soil. Berthollet and the chemists rivalled each other in hastening from department to department, to teach the best mode of extracting the salt; and such improvements were thus introduced, that very soon processes were completed in France in a few hours, which then cost other nations the labour of a month. The result of the whole was an abundant supply of gunpowder for the French camps and fleets, while their arsenals and magazines were stored with ammunition; and the extraction of saltpetre from the soil continues at this day a permanent source of productive employment of the national capital and industry.

Another scarcely less important benefit was at this time conferred on France by her men of science, which seems too much connected with this subject and with our chemist, to be omitted here. There was an urgent demand for cannon, musquets, sabres, &c. to provide and equip one million of men, who were eager to take the field, but wanted arms. The ordinary manufacturer was unable to meet a demand so extensive; and besides, the fabrication of steel, and even of the finer kinds of common iron, was unknown to him. Here again the French philosophers came forward. A committee was appointed, of which Berthollet and Monge were the leading members, remarkable alike for their talents and for their unwearied exertions; valuable improvements were introduced into the smelting and purification of iron; a profound investigation was instituted and completed of the processes by which that metal may be converted into steel; and the immediate result was, that the people became instructed; the nation's wants were supplied for the time, and extensive permanent establishments of that difficult manufacture were formed in various parts of the country.

It was not only, however, by their talents, nor yet by their ingenuity, that Berthollet and his friends were enabled to aid and to enlighten their country. Occasions presented themselves in which their integrity, and that rare quality of civil courage, were not less conspicuous. It was this, indeed, which greatly contributed to give them at first the perfect public esteem and confidence which they long enjoyed. During the reign of terror, a short time before the ninth Thermidor, when the system was a favourite one of raising up pretended plots to give pretexts for fresh ravages of the guillotine, a hasty notice was given in a certain sitting of the committee of public safety, that a conspiracy had just been discovered to destroy the soldiers, by poisoning the brandy which was ready to be served out to them just previous to an engagement. It was said that the sick in the hospitals who had tasted this brandy all perished in consequence of it. Immediately, orders to arrest all those implicated in suspicion, or rather those previously marked for execution, were issued, and numbers in chains awaited their doom. To Berthollet it was referred to analyze this liquor; he

was at the same time fully aware that Robespierre *would* have a conspiracy, and all knew that opposition to the will of that monster was generally death. Having finished his analysis, Berthollet drew up his results in a Report, which he accompanied with a written explanation of his views, and he there stated in the plainest language the simple truth, that there was nothing very detrimental mingled with the brandy, but it was merely diluted by water holding small particles of slate in suspension—an ingredient which filtration would speedily render innoxious. This Report deranged the plans of the Committee of Public Safety, who accordingly sent for the author to convince him of the inaccuracy of his analysis, and to persuade him to alter its results. Finding that he remained unshaken in his opinion, "How, Sir!" exclaimed Robespierre, "darest thou affirm that muddy brandy is free from poison?" Berthollet immediately filtered a glass of it, and in the presence of Robespierre drank it off. "Thou art daring, Sir, to drink that liquor," said again the ferocious President of the Committee. "I dared much more," replied Berthollet, "when I signed my name to that Report." This was indeed to take the hungry lion by the beard, and it is probable that a revolutionary tribunal would soon have rewarded his integrity, were it not that the same shield which defended the physician of Louis XI. protected also the life of our chemist. The knowledge of each was necessary to the existence of the tyrants whom they had the misfortune to serve.

(*To be continued.*)

EXPERIMENT ON TREES.

M. Thouin states, that the gardeners of Genoa, Florence, Venice, &c., choose an orange-tree, of which they cut off the branches; the trunk is then perforated through its whole length, and through the roots to the ground beneath. They then select young plants of the jasmine, the dwarf almond with double flowers, fig-trees, rose-trees, myrtles, and other ornamental plants, and these being arranged in twos, or threes, according to fancy and the size of the aperture in the orange-tree, are planted either in the ground or in a tub, according to the climate, passing them through the orange-tree, so that the plants may reach a short distance above the upper end of the trunk; the roots of the tree are then covered with earth, watered, and cultivated, as if it were a tree just planted. The tree and the young plants all grow together, and will live for ten or fifteen years.

This experiment was repeated by M. Thouin, at the agricultural school, at Paris. A *tilleul*, (linden-tree) 11.8 inches in diameter, was taken up with parts of its roots, and cut horizontally about the height of forty inches; the roots were shortened to about twenty inches, and the fibres thinned, or entirely removed, where too abundant. The trunk was then bored and converted into a cylinder, having an internal diameter of about six inches, the fresh wood being trimmed so as to remove any broken parts. The young trees were seven in number, raised from seeds, aged from two to four years, having strong roots and straight stems, about 64 inches long. They were of very different families. The roots were trimmed, the branches removed, and the extremities of the stems cut off. These were planted on March 15, 1813, in a circular hole, a yard and a half in diameter, the roots being led outwards and the stems being lightly tied together: a little earth was then sprinkled over them, and afterwards the perforated trunk put in its place, being let down over the young plants, the stems of which were guided through it. Good earth was then put in amongst the roots, and the ground covered up and well watered. After being planted, the stems of the small plants were retained at an equal distance from each other, and from the sides of the aperture, by pads of moss, inserted at the aperture;

and a direction outwards was given to them, by fastening them to a hoop. The plants were watered in times of dryness or of heat with muddy water, four or five holes being made about the group, that the air and water might have access to the roots of the young plants. In order to equalize the growth of the plants, that one might not rob another, such as were most vigorous were deprived of their small branches and buds; and sometimes the stems were bent so as to prevent the sap from circulating with too much facility. During the winter, the weakest plants were cut short, that the few buds left might receive a greater accession of nutriment, while the stronger ones were left of greater length. The trunk of the tree, though perforated completely, threw out many buds on its surface; these were left to grow the first year, but in after years those branches were removed which interfered with the other plants. Such was the growth of the plants thus enclosed, that in a few years they entirely filled the cavity of the perforated tree, after which, the sap not being able to return freely to the roots, a swelling was formed at the top of the old trunk, which after some time expanded, so as to make every trace of the cavity covered by it disappear. It was then necessary, for other reasons, to cut down this group of trees; but had it remained, there is no doubt but the different plants would soon have yielded fruit, probably to an excessive degree, from the hindrance to the return of the sap.

This experiment was varied by cutting a tree while standing so as to leave a trunk between six and seven feet long; it was bored as it stood, as low as the roots, and then holes were made through the side; the young plants were then introduced through these holes, which were afterwards covered with earth, &c.

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NAVAL ARCHITECTURE.

To the Editor of The Chemist.

Sir,—Though I have been a constant reader of your Publication since its commencement, I should never have dreamed of addressing your scientific Journal on the subject of my present communication, had it not been for an article published in the last Number of the Quarterly Journal of Science. In one of your early Numbers you exposed, and I thought justly, the bad faith of that leading scientific journal; and I therefore hope you will not refuse me an opportunity of showing up its ignorance and profligacy. I say profligacy, Sir, because I can find no other term to signify a base attack on a whole class of meritorious mechanics, apparently dictated by a wish to gratify the founders of an abortive school. In imitation of our continental neighbours, among whom it has always been a favourite object to separate the learned from the unlearned, a school of naval architecture was established a few years ago in this country; and its supporters are now trying to obtain, by means of puffs, direct and indirect, great praise for their misconceived, misbegotten, and antinational academy.

Sir, you will not wonder, I think, at my indignation, when I tell you that I am a working *shipwright* in one of his Majesty's dock-yards; and that the effect, if not the object, of the school of naval architecture at Portsmouth dock-yard, which the article in the Quarterly Journal is intended to hold up to our admiration, is to exclude every individual of the class to which I belong from any and every promotion in the government dock-yards, higher than that of a working man; and this too, Sir, when we are doing all in our power, by improving our own education and the education of our children, to render us fit for any situation. Sir, that school has put an end to every species of generous emulation among the rising generation of

shipwrights, and left them no other stimulus for exertion but their daily wages. But I forget, Sir, that probably neither you nor your readers are acquainted with the existence of this school, or with the article which has made me take up my pen; and, with your permission, I will say a few words on both.

About thirteen years ago there was established at Portsmouth dock-yard a school of naval architecture. At this school all the young men *intended* for officers in the King's dock-yards are to receive a scientific education. I believe there is no restriction as to the admission of pupils, further than that they must undergo a previous examination, and give proofs of possessing a good memory, by showing they recollect an adequate quantity of the French language and mathematics they have been taught at school. Now, Sir, before this school was established, every shipwright's apprentice in the King's dock-yards might hope by his own exertions to rise to be master shipwright, or even surveyor of the navy. Examples of such a rise are, in fact, not wanting; and some, if not all, of our most useful shipbuilders have so risen. But it is a part of the present plan, that only the young men educated at this school are henceforward to be appointed to these high places. They also, and they only, are to be appointed foremen, and to fill those other subordinate situations through which working shipwrights formerly attained higher offices. Thus, Sir, *every working shipwright* in the King's dock-yards now sees himself and his children, whom he may bind apprentice to his own trade, for ever debarred from the chance of becoming an officer in the dock-yards; and he sees a peculiar and select class, with whom he never mingles, and with whom he has no community of feeling, of interest, or opinion, appointed, almost from infancy, to be his masters. This is depriving the shipwrights, who before thought they were hardly treated, of one of their most cherished and most esteemed privileges. I am sure, Sir, I speak the sentiments of the great body of working shipwrights, when I say, this has done more to detach them from the service of the government than any measure ever before adopted in the dock-yards. In principle it is the same as never allowing a soldier or a sailor to become an officer. It selects a class for the particular duties of masters, and stamps all the others with the stigma of degradation and servitude. Opposition and hatred are the consequences; and however theoretically *scientific* the new master builders may be, than can never succeed, because they never will meet with cordial co-operation.

Sir, it is this *school*, founded on this narrow, exclusive, and slavish principle, which the article in the 36th Number of the Quarterly Journal, signed "Alpha," is intended to recommend to public admiration. "Till its establishment," it is there stated, "*few persons* in any of our naval arsenals ever thought of guiding their practice by maxims drawn from the *legitimate* principles of science;" meaning, I suppose, by *legitimate principles*, principles lawfully begotten in the cranium of some lawfully appointed professors of abstractions. But allowing these *Holy Alliance* parts of science to be all-important, and passing without further observation the imputation thus attempted to be cast on our best ship-builders, in all times, past and present, I shall call your attention to the passage which describes what the pupils are taught at the *school of naval architecture*.

"They (the scholars) have indeed enjoyed great and eminent advantages. They have been instructed in all the essential elements of mathematical science. They have had the writings of Atwood, of Chapman, of Bouguer, and of many other eminent theorists, placed in a familiar aspect before them; and been taught to apply many of their maxims to actual examples. They have moreover been taught the higher uses of a *calculus*,

which in every branch of science, to which its transcendant powers have been applied, has surmounted the greatest obstacles, and revealed in living characters the most mysterious phenomena of the universe."

This is a pretty period, undoubtedly, but when examined does not much tend to exalt the academy in our estimation. The highest praise this author can bestow on it is, that the scholars are taught *algebra*. Sir, I ask, is it not notorious, that some of the greatest mathematicians have been utterly ignorant of all practical knowledge, and utterly incapable of fulfilling the duties of a man of business. The calculus will not make them good ship-builders. I do not say it is wrong to teach them mathematics; but I aver, that is preposterous to set a knowledge of them before that practical knowledge which our master builders have hitherto possessed, and which has framed our ships, as experience has shown, so as to answer all the purposes of ships; and I aver, that this *school* education can give the young men no insight whatever into the duties they will afterwards have to perform. I am borne out in this assertion by what has already taken place. Not one improvement has been known to emanate from that academy; and the only novel scheme it has yet sent forth was one for caulking ships, which was deservedly scouted by every shipwright. Not one man of genius, I believe, has yet issued from it: the learned professor, Mr. Inman, be it remembered, whose trial ship is not equal to the one planned by Captain Hayes, is not a child of this institution. One man of promise it has indeed produced, Mr. Bonnycastle, whose services, if I am not misinformed, have been already transferred to the United States of America. I can also tell Alpha, " whatever union of scientific skill and practical experience" he may have "witnessed in the students of this school," that they have been the jest and mockery of those officers with whom they have had to act, and have excited *contempt* in the *workmen* they have had to command. Every other thing is sacrificed in their education to the acquisition of mathematical knowledge; and they are taught the uses of a calculus to assist them in laying off a stern frame, or to show them how to square a piece of timber. And simply, because our shipwrights up to this period have done without this calculus, all their other varied and practical knowledge passes for nothing; and they are described by Alpha, though we have the most efficient navy of the world, as " having to an unaccountable degree neglected the cultivation of those branches of knowledge on which ship-building so essentially depends." If this is not an ignorant as well as *profligate* aspersion of the characters of a whole class of men, merely because they have not been mathematical theorists, such as M. Fourier, mentioned in your last Number, I know not where we shall find one! It is really too much, Sir, not only to be debarred from all promotion, but to have our characters taken away, and all the knowledge on which we have prided ourselves contemned, because we cannot use a calculus with the skill of a La Place.

But I see, Mr. Editor, that I am trespassing on your patience and on your kindness; and though I have not said all I might say against the absurd article in the Quarterly Journal, I must here stop. If this communication, however, merits insertion, and you wish it, you will find me ready hereafter to renew the subject; and in the mean time,

I remain,
Your obedient servant,
A Working Shipwright.
River Side, Feb. 14.

ENGLISH FIRE-SIDES.

To the Editor of The Chemist.

Sir,—Mr. Boyce's estimate of 50*l*. for an air grate must be an exaggeration: there is one at Mr. Williams's, 78, Cornhill, which was erected more than six years ago;

and which effectually warms three floors; it was put up at an expense of 25 guineas, and then considered to have been very liberally paid for. No doubt a similar grate, tubes, pipes, &c. might now be constructed for 20*l*.

AMBULATOR.

In consequence of this note we went to see Mr. Williams's stove, and found it one of those for which the Marquis de Chabannes had a patent; and which, perhaps on account of the patent, have never come much into use. This is an iron stove, the fire-place in which may be of any shape; but the grate must be at some height from the ground, and the back of it must be at some distance from the wall, so that a current of air entering below the fire-place may pass upwards, through, and behind the fire. The consequence of this construction is a very rapid combustion, so that any degree of heat may be obtained, and every sort of rubbish burned. Behind and above the actual grate, where the coals are burning, is a large iron box or reservoir for air, which receives its supply from several tubes descending from its lower part. In principle it is precisely the same as the fire-place described at page 8 in our present volume; but both the grate and the receiver obtain their supply of air from the apartment, the first circulating air already partly contaminated, and the second carrying off a portion of the air already heated. We hold, that in these two points it is not so advantageous as Desarnod's fire-places; but, like them, it can be made of any degree of beauty, and will give out a great heat at a small expense. Mr. Williams's whole shop, and apartments over it, are heated by this stove; and, as we have stated would be the case, (Chemist, p. 318.) the upper rooms are heated by the mere ascent of the heated air, neither tubes nor pipes to convey it being necessary. The air of this stove never has a burnt or disagreeable smell; and we are disposed to believe, if such stoves were manufactured on the large scale, without the tubes, which are of little use, they could be made at one-fourth of the sum mentioned above. It is probable, that stoves of this description, or something like them, will come speedily into general use.

CINCHONINA.

(*In answer to a Correspondent.*)

CINCHONINA and quinina are both obtained by the same process, but one is the produce of the red, and the other of the yellow bark: that process is as follows:—Reduce two pounds of the bark to powder, and digest it twice with two ounces of sulphuric acid diluted with sixteen pounds of water. Filter the decoctions, which have a reddish yellow tint. By adding pulverized quick lime, the decoction is *bleached* or discoloured, and the acid separated. Pass the liquids through a cloth, and the precipitates which remain must be washed with a small quantity of water, to separate the excess of lime. The deposit being drained and deprived of moisture, is digested in alcohol, and on this being distilled off, a brown viscid matter is obtained, which on being cooled becomes brittle. This is to be acted on with water acidulated with sulphuric acid, and, on the liquid being set by, will deposit white crystals, which are sulphate of cinchonina if red bark has been used, and of quinina if the yellow bark has been subjected to the process. By dissolving this salt, and adding an alkali, cinchonina is precipitated, which, on being dissolved in alcohol, may be obtained in crystals. We are not exactly aware of the relative cost of this substance.

TO CORRESPONDENTS.

Such of our Correspondents as do not find their communications inserted in the present Number, and no acknowledgment made of them, are requested to have patience with us till next week.

*** Communications (post paid) to be addressed to the Editor at the Publishers'.

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The Chemist.

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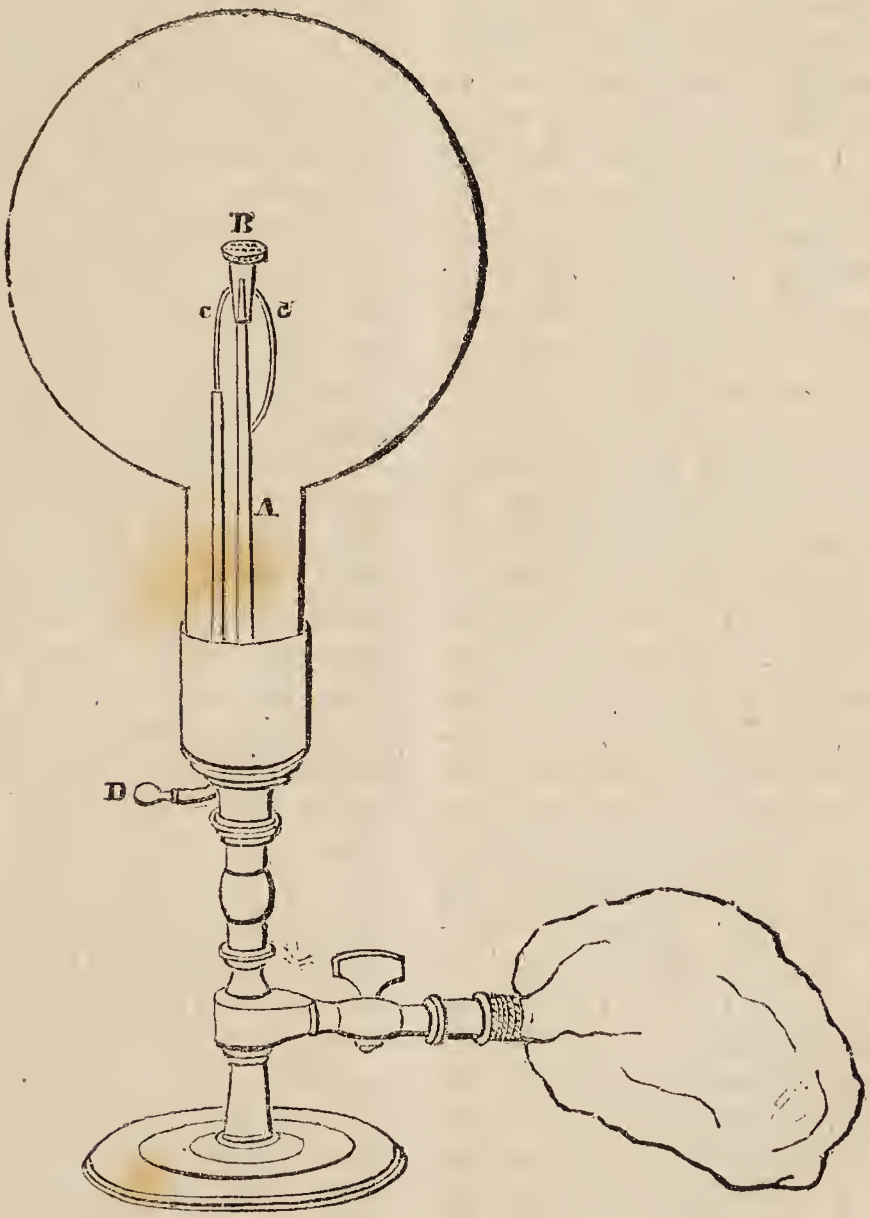

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LECTURES AT THE ROYAL INSTITUTION.

CARBONIC OXIDE. CARBONIC ACID.

Lecture 25. Having before, Mr. Brande said, pointed out the sources of carbon, and some of its properties, he meant then to proceed to its combinations with oxygen. It unites with oxygen in two definite proportions, and forms two compounds, *carbonic oxide* and *carbonic acid*. Before stating any thing further of them, it may now be mentioned, though somewhat out of place, that the former is a compound of 1 proportional oxygen and 1 proportional carbon, and the latter is a compound of 2 proportionals oxygen and 1 of carbon; carbonic oxide is therefore usually obtained by subjecting carbonic acid to the action of some substances, such as certain metals, which are oxidized by combining with one portion of the oxygen. It is also obtained by heating chalk and charcoal, or equal weights of chalk and iron or zinc filings, in an iron vessel. If equal parts, also, of oxide of zinc and charcoal be mixed together, and exposed to heat, carbonic oxide is obtained. The carbonic oxide, when obtained, should be well washed with water. 100 cubic inches weigh 29.7 grains; its specific gravity is to air as 98 to 100, and to hydrogen as 14 to 1. That it is lighter than oxygen is owing to the oxygen increasing in bulk by combining with the carbon. If we say that 1 proportional of carbon is 6, the proportional of oxygen being 8, we shall have 14 for the equivalent of carbonic oxide, and the oxygen, by the union with this proportional of carbon, will have doubled its volume;—or we may suppose that one volume of carbonaceous gas has combined with one volume of oxygen to produce two volumes of the oxide. The real nature of this gas was first pointed out by Mr. Cruikshank, of Woolwich: before his experiments it was supposed to contain hydrogen, but he found, if it were burnt under a glass, no moisture was formed, which would be the case did it contain hydrogen. Carbonic oxide is fatal to animal life, and a taper is extinguished in it, but it catches fire itself, and forms carbonic acid by absorbing oxygen from the atmosphere. The same result is obtained when two volumes of this gas are combined with one of oxygen and fired by the electric spark. Nothing is obtained but carbonic acid, which equals in volume the oxygen employed. This gas is not altered by being passed through a red hot tube, nor is it decomposed by phosphorus at high temperatures. Potassium burns in it at a red heat, decomposes it, combines with its oxygen, and carbon is deposited in the form of a black powder. To make this experiment, put a piece of potassium in a retort, exhaust it of the air, and then admit into it carbonic oxide gas; apply the heat of a spirit lamp to the retort, and if the heat be sufficiently great, the potassium will catch fire and absorb all the oxygen, all the charcoal being deposited in the form of powder. This experiment was made, and to make the heat sufficiently great, Mr. Faraday urged the flame with a common blow-pipe. From this experiment we see that carbonic oxide, though it puts out the taper, supports the combustion of the potassium; and we see also that though in general the attraction of carbon for oxygen is greater than that of most bodies, it is not equal to that of potassium at high temperatures. Carbon will, in general, take oxygen from other bodies; which is the reason that it is employed in the reduction of metallic oxides, and in various other processes of art.

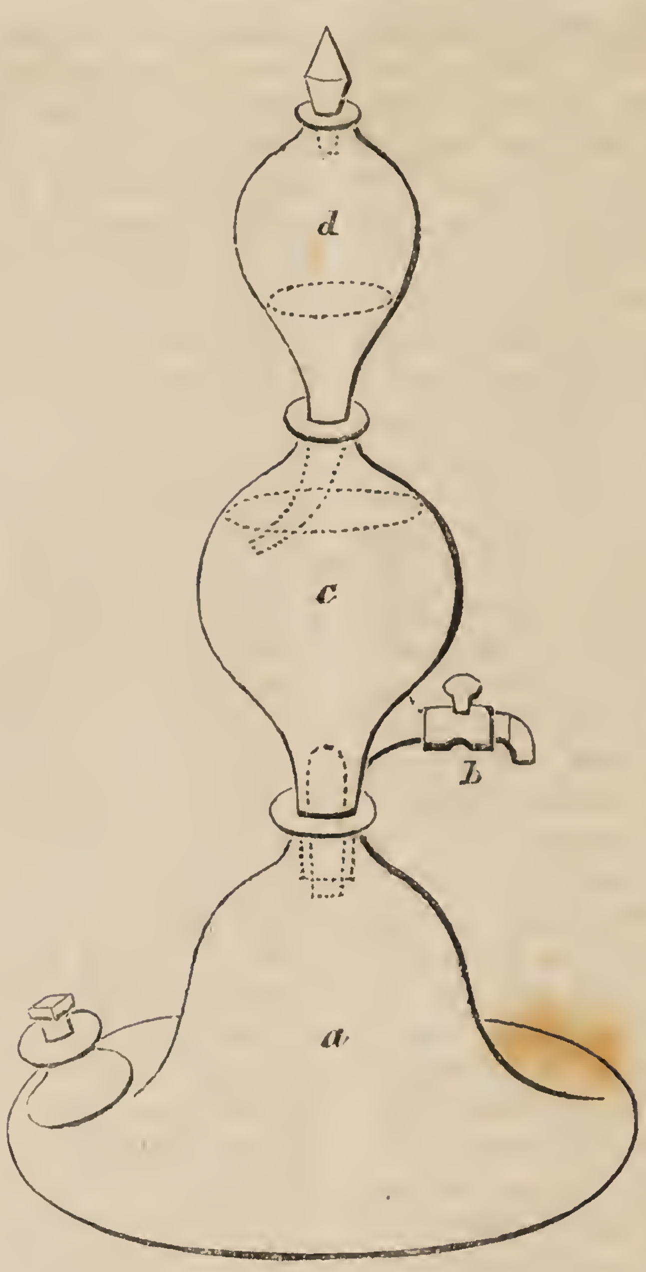
Chlorine and carbonic oxide combine and form *chlorocarbonic acid*, or phosgene gas, as it was called by Dr. John Davy, its discoverer. It is easily formed by mixing equal volumes of chlorine and carbonic oxide, and exposing them to the action of light, when they suffer condensation, and chlorocarbonic acid is the result. It is a compound of little or no in-

terest, and is only mentioned because it belongs to this place. It consists of one volume chlorine and one of carbonic oxide, condensed into one volume. 100 cubic inches weigh 105.9 grains, and its specific gravity is to hydrogen as 50 to 1. It has a very peculiar odour, which, when much diluted with atmospheric air, is not disagreeable, but of itself is extremely irritating and offensive.

Carbonic acid consists of 1 volume carbon, 6, and 2 of oxygen, 16, the united bodies having the same volume as the oxygen, and its equivalent being 22. It is obtained by burning carbon in oxygen gas, and whether diamond or pure charcoal be used, the results are the same. We are indebted to Lavoisier for this knowledge, for he was the first person who examined the chemical nature of the products from burning the diamond. When charcoal is burned in oxygen gas carbonic acid is formed; and if we use a piece of charcoal on which the bark remains, brilliant scintillations take place; but the operator must be careful to confine the jar in which the combustion takes place, as it is apt to be forced away by the little explosions. This experiment was performed, and it was shown that the volume of the oxygen remained unchanged. 100 cubic inches weigh 46.9 grains; its specific gravity is to that of air as 1.544, to hydrogen as 22. It is not exactly known to whom the idea of diamond being combustible first occurred, but the Florentine Academicians first made the experiment, by exposing it among other gems to the intense heat of a burning lens. Lavoisier repeated the experiment, and since his time Mr. Tennant has burnt it by means of red hot nitre; and Messrs. Allen and Peyps have also made experiments on the same subject. One of the most convenient apparatus for performing this experiment is the following:—

It consists of a glass globe, of the capacity of about 140 cubical inches, furnished with a cap, having a large aperture; the stop-cock, which screws into this cap, has a jet, A, rising from it, nearly into the centre of the globe; this is destined to convey a small stream of hydrogen, or other inflammable gas. Two wires, *c c*, terminate at a very little distance from each other, just above this jet, and are intended to inflame the stream of hydrogen by electrical sparks; one of them commences from the side of the jet, the other is enclosed and insulated nearly in its whole length in a glass tube: the tube and wire pass through the upper part of the stop-cock, and the wire terminates on the outside in a ball or ring, D, at which sparks are to be taken from the machine, either directly or by a chain. On the end of the jet is fixed, by a little socket, a small capsule, B, made of platinum foil. This capsule is pierced full of small holes, and serves as a grate to hold the diamonds. Its distance is about three quarters of an inch from the end of the jet; and the arm, by which it is supported, is bent round, so that the stream of hydrogen shall not play against it. The stop-cock screws, by its lower termination, on to a small pillar, fixed on a stand, and at the side of this pillar is an aperture by which a bladder filled with gas may be connected with the apparatus.

On using the apparatus, the diamond is to be placed in the capsule; and then the globe being screwed on to the stop-cock, the latter is to be removed from the pillar and placed on the air-pump; the globe is then to be exhausted, and afterwards filled with pure oxygen: or, lest the stream of oxygen in entering should blow away the diamond, the globe may be filled with the gas first, and then, dexterously taking out the stop-cock for a short time, the diamonds may be introduced and the stop-cock replaced. The apparatus is then to be fixed on the pillar, and a bladder of hydrogen gas attached to the aperture. Now, passing a current of sparks between the wires, a small stream of hydrogen is to be thrown in, which inflaming,



immediately heats the capsule and diamonds white hot; the diamonds will then enter into combustion, and the hydrogen may be immediately turned off and the bladder detached. The diamonds will continue to burn, producing a strong white heat, until so far reduced in size as to be cooled too low by the platinum with which they lie in contact.

When the flame of hydrogen is used to heat the diamonds, it is evident a little water will be found in the globe, but this is of no consequence except in attempts to detect hydrogen; the inconvenience may be obviated, if required, by using the flame of carbonic oxide. As, however, no hydrogen has at any time been detected in the diamond, it is better to use that gas as the heating agent; for then the carbonic acid, produced by the combustion, is unmixed with that from any other source, and may be collected, and its quantity ascertained.

In making this experiment the hydrogen flame reached the top of the globe, and it instantly burst, destroying, too, with its ruins, the vessel in which Mr. Brande had shortly before formed chlorocarbonic acid; and consequently its fumes, though not disagreeable except to those in its immediate neighbourhood, filled the class-room. Mr. Brande said he regretted this accident, as he was prevented by it from showing that the products of burning diamond and burning charcoal were precisely the same, and were in both cases carbonic acid gas.

Carbonic acid exists also abundantly in nature, and one of the most ready modes of procuring it is to subject any of the carbonates to the action of stronger acids. It

may be easily obtained by pouring dilute muriatic acid on marble, which is a carbonate of lime; and it is by this means that it is generally obtained for experiment. It may be collected over water, but cannot be retained over it, as water absorbs at ordinary pressures about its own volume of the gas; when the pressure is increased to two atmospheres it absorbs double its own volume, its absorbing power increasing as the pressure. Water thus impregnated with the acid acquires acid properties. Carbonic acid has been condensed into a liquid; but for this purpose it requires a pressure equal to forty-two atmospheres. In this state it is rather dangerous handling, as the heat of the room renders it liable to expand into gas, and the glass to burst; but if kept in a cold mixture it may be examined, and is found to be a transparent liquid body, but it assumes the gaseous form with great energy whenever the pressure is removed.

To promote the absorption of carbonic acid by water, various contrivances have been invented. One of the longest known, and most simple, is that called Nooth's apparatus. It is represented in our second plate. It consists of three vessels; the lowest, *a*, is flat and broad, so as to form a good basis; it contains the materials for producing the gas, and an aperture for introducing them. The generated gas passes through the tube *b*, in which a glass valve opens upwards into *c*, which contains water, or the solution to be impregnated with the gas, and which may be drawn off by the stop-cock. The tube of the uppermost vessel, *d*, dips into *c*, and occasions some pressure. At the top of *d* is a heavy stopper, which acts as a valve, and also occasions a considerable pressure. The gas which is not absorbed either in *c* or in *d* escapes at this aperture. This, or some similar apparatus, is much employed to impregnate water, so as to resemble mineral waters, and to make soda water. The apparatus for this latter usually consists of a forcing pump and strong barrel, by which a pressure equal to five or six atmospheres is produced. Some of the carbonic acid is wasted in afterwards bottling the liquid, but with dexterity this quantity is small.*

Fermented liquors also contain carbonic acid gas, and owe their effervescing power to its presence. We can make it visible, or extract it from them, and from water, by boiling the liquid, and by placing it in the receiver of an air-pump; it is also given out by water when it freezes. Water impregnated with the acid reddens litmus paper, but this soon acquires its original colour, by the acid escaping. This serves to distinguish carbonic acids from acids that are less volatile. When lime water is mixed with carbonic acid it becomes turbid; but it must always be remembered, that an excess of acid again dissolves the lime and restores the transparency of the fluid. Carbonic acid extinguishes flame, and is fatal to animal life: potassium, however, burns in it. This acid collects at the bottom of mines and wells, and is then called choke damp: care should be taken to test the purity of the air in them, by sending down a lighted taper before men descend into them. Being heavier than air, it not only lies at the bottom of wells and such places, but it may be freely poured from one vessel into another, mixing somewhat slowly with the atmosphere. Carbonic acid is a product of respiration and of the combustion of most fuel. A man emits half a pound weight of carbonic acid every twenty-four hours; and the gas produced from these two copious sources is afterwards again decomposed by vegetables, or by some other means with which we are not acquainted. It is somewhat difficult at first to believe that a substance obtained in so many

* We have already described, at page 274 of our first volume, an apparatus which possesses considerable advantages for promoting the absorption of the gases, and which seems not yet sufficiently known.

different manners, and from such a variety of sources, is always the same, but such is the case. Carbonic acid, in its combination with other bodies, is held by very feeble attraction, and is generally evolved with effervescence by the addition of any other acid.

Mr. Brande then proceeded to burn potassium in carbonic acid. The flame was of a dark gloomy red; it is necessary to introduce the potassium in a state of intense combustion, when the whole of the oxygen combines with the potassium, forming the alkali potassa, the carbon being deposited. This experiment, the Professor observed, showed the absurdity of the term oxygen; in its union with the carbon it really formed an acid, but liberated from that union, and combined with the metal potassium, it formed an alkali. The acidifying property, therefore, attributed to the oxygen, and the circumstance after which it was named, belongs, in fact, to the bases it combines with. The potassium takes the whole of the oxygen from the carbonic acid; iron heated red hot also decomposes it, but takes only one portion of its oxygen, and carbonic oxide remains. If carbonic acid be passed over red hot charcoal, it takes up more of this substance, and becomes carbonic oxide. We very often see in a clear charcoal fire a blue flame on the top, which arises from carbonic oxide formed in this way. The air entering at the bottom forms carbonic acid, some of which, in its progress through the upper stratums of heated charcoal, is converted into carbonic oxide, and burns on the surface with this pale blue flame.

Carbonic acid forms, with the salifiable bases, a number of salts, called carbonates, only one of which will now be adverted to, because only one of these bases, namely, ammonia, is yet known to the student. When one volume of carbonic acid and two volumes of ammonia are mixed together, they combine, and completely condense each other, producing a white concrete salt. This is one of the most useful and best known of the ammoniacal compounds; it is extensively employed in the arts and in medicine, and is manufactured on the large scale in various places. It is a compound of one proportional acid, 22, one ammonia, 17, its equivalent being 39. The carbonate of ammonia of commerce is obtained from mixing muriate of ammonia and carbonate of lime, and is generally in a state of *hydrated carbonate*. The qualities of that obtained in commerce vary very much; so much so, that we can never be certain of the effect of the salt from its use. Its taste is hot and saline, and the alkaline properties of the ammonia predominate over the acid properties of the carbonic acid. In the next lecture the compounds of chlorine, iodine, and hydrogen will be brought under notice.

STAGE COACHES AT PARIS.

In 1766, 27 coaches set out from Paris daily for the different provinces of France, and they conveyed about 266 passengers; now nearly 300 coaches leave Paris every day, which are capable of carrying more than 3000 passengers. The produce of the taxes on coaches was farmed in 1792 for 600,000 francs; the revenue now obtained from public coaches in France is four millions of francs. Toward the middle of the last century, the conveyance from Lyons to Paris cost 50 francs, and the traveller arrived on the tenth day; the price is now 72 francs, and the journey is performed in less than three days. Formerly the coach to Rouen made the journey in three days; and the price of a place was 15 francs; the same price is now paid, but the journey is performed in 12 or 13 hours. In 1766, there were in Paris 14 establishments for transmitting goods by wagons, now there are 64. These details are extracted from a memoir, by M. Girard, on the Advantages of different Modes of Communication. We do not know that the same sort of com-

parative statistics is ever published of London; if they were, we suppose we should find both the increase in the number of coaches and in the rate of travelling even much greater in London than in Paris. At least we know, that the number of stage-coaches in London is now much greater than in Paris, and that they travel with greater velocity than French stages.

EASY METHOD OF REMOVING A GOLD RING.

If we could as easily break the moral connexion of which a ring is the emblem, as this emblem may be removed from the finger when it begins to annoy us, we should be *run after* by many husbands and wives: "Herein, however, the patients must minister to themselves," and all which comes within our province is to point out how a gold ring which is too small may be easily got rid of.

Take a little quicksilver and rub it upon the ring, which will soon be penetrated with it, and become so fragile that it will break without the least exertion. Quicksilver has the property of uniting very easily with the greater number of the metals, and forming a soft compound called an amalgam.

WHAT WE DRINK.

By means already described in The Chemist, we can separate, without employing distillation, the alcohol or the intoxicating part of all liquids completely from the water, mucilage, extract, colouring matter, and other substances with which it is mixed, constituting the various sorts and classes of spirituous liquors. By such experiments it has been ascertained, that the following liquors contain the proportions of spirit in 100 parts, by measure, as below:—Wines, Lissa 25.41, Raisin 25.12, Marsala 25.09, Port 22.96, Madeira 22.27, Currant 20 55, Sherry 19.17, Teneriffe, Constantia, &c. 20.35, Cape 20.51, Grape 18.65, Vidonia, White Hermitage, &c. 17.26, Claret 15.10, Burgundy, Malmsey, the Sicilian and Greek wines 14.57, Champagne, Nice, &c. 12.61, Red Hermitage and Vin de Grave 13.37, Frontignac, Gooseberry, and Orange 12.26, Tokay 10; Cider 7, Perry 7, Mead 7.30, Ales (average of several) 6.87, London Porter 4.20, Small Beer 1.28, Brandy 53.39, Rum 53.68, Gin 51.60, Scotch Whiskey 54.32, Irish Whiskey 53.90. The remainder parts per cent. of all these liquids is chiefly water; and what is more, the *alcohol* may, say some chemists, be considered as a compound of olefiant gas 61.63, and WATER 38.37 parts in the hundred. So that the lover of ardent spirits is, in fact, a great lover of water; and it may be doubted, whether he who drinks vast quantities of wine, beer, or brandy, does not, in fact, drink more water than he who is called a water drinker. It is at any rate clear, that water forms a great part both of our drink and our food, and that vegetables are not the only organised beings of the creation which subsist chiefly on water.

FRICTION ON RAILWAYS.

Much attention has lately been excited, *apropos* of railways, by the assertion that friction is in all cases not altered by any degrees of velocity, and that it is as the time and as the weight. This assertion has been doubted; and to set the question at rest, Mr. Roberts, of Manchester, made the following experiment:—

"It was very difficult (says the *Manchester Guardian*) to devise means for measuring accurately the friction of a carriage moving over a railway, but it occurred to Mr. Roberts, that the difficulty would be obviated, if the railway were made to move under the carriage. When this idea once presented itself, it was easy to reduce it to practice. Mr. Roberts procured a cast iron drum or flat hoop, six inches broad and three feet in diameter, which was made to revolve vertically (like a grindstone) by a pulley and strap. This served

the purpose of a railroad. A small wagon with four cast iron wheels was placed exactly on the top of this drum, and attached on one side to an upright post, forming part of the wooden frame which supports the drum. It is attached to this post by one of Mariott's patent weighing machines, for the purpose of measuring the friction. To ensure greater accuracy, a tempering screw was employed, by which the centre of the wagon could be kept at all times exactly over the axis of the drum; in order that no part of the weight of the wagon might be blended with the pressure produced by the friction. As a farther precaution, a wooden board was so placed on one side of the wagon as to prevent the disturbing action of any current of air generated by the motion of the drum. Now, if the drum is made to revolve with any velocity, say four miles an hour, and the wagon is held in its place, it is perfectly obvious that the wheels will turn on the surface of the drum, precisely in the same manner as if the wagon had moved along a flat railroad; and the friction will be the same excepting a minute addition occasioned by the curvature of the drum, but which will not affect the *relative* friction at different velocities. This will be accurately exhibited by the index of the weighing machine, against which the wagon pulls with a force equal to the friction. The experiment has this grand advantage over those made on level roads, that the resistance of the air is entirely got rid of. The apparatus being adjusted, and the wagon loaded with 50 pounds, (including its own weight,) the periphery of the drum was made to revolve 'at different velocities, varying from *two to twenty-four miles an hour;*' but 'in every case *the friction, as indicated by the weighing machine, was precisely the same.*' And that there was nothing in the construction of the apparatus to produce a fallacious result was evident from this, that though no increase of speed affected the index of the weighing machine in any degree, it immediately showed an increase of friction, when an addition was made to the *weight.* To use the words of the able journal from which we have abridged the preceding statements, there is no doubt that 'goods may be conveyed from Manchester to Liverpool with very nearly the same expenditure of steam, whether they are carried two miles, or four miles, or twenty miles an hour.'"

DICTIONARY OF CHEMISTRY.

Germination. The beginning vegetation, or growth of seeds, is called germination.

Gieseckite. A mineral of a greyish-brown appearance, so named after M. Giesecke.

Gilding is the art of covering the surfaces of bodies with gold, and there are numerous modes of accomplishing this process, as well as numerous substances gilt.

Gin is said to contain about 61 parts in the hundred, by measure, of alcohol.

Glacial Phosphoric Acid, *fused phosphoric acid.*

Glacies Mariæ, *mica.*

Glance. A name given to several minerals, which have a sort of metallic lustre. There is glance-coal, glance-silver, lead-glance, &c. &c.

Glaser's Polychrest Salt. A mixture of sulphate and sulphite of potassa, obtained by sprinkling sulphur on hot nitre. It was formerly used in medicine.

Glass. A substance too well known to our readers to require any definition. At present there are five kinds manufactured, to wit, 1st. Flint Glass, composed of purified Lynn sand 100 parts, litharge 60, purified pearl-ash 30. A little black oxide of manganese, or nitre, or arsenic, is added, to correct the green colour. The fusion of the materials is usually completed in thirty hours. 2d. Plate Glass, composed of pure sand 43 parts, dry carbonate of soda 26.5, pure quick-lime 4, nitre 1.5, broken plate glass 25. From these 100 parts about 70 parts of

good plate glass may be obtained. 3d. Crown Glass is best made by mixing 200 parts of fine purified sand and 330 parts of the best kelp, ground. 4th. Broad Glass, or coarse window-glass, is made of soap-boilers' kelp and sand. 5th. Bottle Glass, the coarsest kind, is made of soap-boilers' waste and river sand.

Glauberite. A mineral composed of dry sulphate of lime and sulphate of soda.

Glauber's Salt, *sulphate of soda, sal mirabile, salts.* A substance well known for its purgative properties.

Glazing, in chemistry, is the art of covering pottery with a crust or enamel.

Glimmer. *Micaceous earths* are sometimes so called.

Gliadine. The name given by M. Taddey to an ingredient found by subjecting gluten to the action of alcohol, in which it is soluble. It is of a straw colour, slightly transparent, and brittle, having a slight smell, and, when heated, having the odour of boiled apples. It has a sweet, balsamic taste. It approaches resin in its properties.

Glowing Lamp, *a phlogistic lamp*, the lamp which burns without flame.

Glucina. One of the earths, first discovered by Vauquelin in aqua marina and emerald. It is supposed to be an oxide, having for its base a peculiar metallic substance, to which the name of Glucinum has been given.

Glue. A coarse sort of gelatine, or jelly, made from the parings of hides and other offal.

Gluten. One of the substances into which wheat flour may be separated, by being made into a paste and washed with water. It is tenacious, ductile, somewhat elastic, and brownish-grey. It is insoluble in water, has scarcely any taste; when dry it is semitransparent, and nearly resembles glue in its appearance. Exposed to heat it cracks, swells, and burns like a feather or piece of horn. It affords the same products when distilled that animal matters afford, which it, more than any other vegetable product, resembles. It may be divided into two substances by alcohol, one of which is called *gliadine* and the other *zimome.*

TO MAKE A MICROSCOPE.

Take a piece of brass, and form it into the shape of the figure, making a small hole in it at A, about the 24th part of an inch in diameter; then holding it by the other end, B, take up a drop of water upon a pin, and lay it on the hole A: the water will remain on the aperture in the form of a hemisphere, or plano-convex lens. Or, a double convex lens may be made by thrusting the pin through the hole till the water be entered into it, and then drawing the pin perpendicularly through the hole. When an object is to be viewed by this microscope, take it up upon a pin, or piece of glass, and, holding the brass by the end B, move the object till it be in the focus, and it will then be seen as distinctly as by a glass microscope, especially by candle-light.

MAXIMUM DENSITY OF WATER.

Some difference of opinion has long existed as to the thermometric point at which water had the greatest density. Professor Hüllström has lately made some experiments on the subject; and according to them water attains its greatest density at 39.394 Fahr. He further allows 0.428 Fahr. as a possible error on either side of this estimate, on account of the dilatation of the glass.

LIFE OF BERTHOLLET.

(*Continued from p.* 348.)

In 1792, Berthollet was named one of the Commissioners of the Mint, into the processes of which he introduced considerable improvement; in 1794, he was appointed a member of the Commission of Agriculture and the Arts; and in the course of the same year he was chosen Professor of Chemistry at the Polytechnic School, and also in the Normal School. In these situations, however, it must be confessed that his mode of communicating his views was not adapted to the level of a general audience. He was too apt to presuppose a degree of knowledge or talent in those listening to him, which it is vain to expect in any public audience; and of course the Professor dwelt too little upon elementary explanation and detail. A teacher should suit his discourse at least to the ordinary average of mind which he is called upon to instruct, and if he commence in a strain too high, his hearers are not carried along with him as he unfolds his views. It is on this account that men of the greatest genius have frequently been the least successful instructors, and it is certain that the faults just mentioned accompanied the lectures of M. Berthollet.

The same year is remarkable in the life of Berthollet and in the history of science, the intimate connexion between which we have often already had occasion to remark, by the establishment of the celebrated *Annales de Chimie*, a work to which, from the first, he has been a principal contributor. This is a journal which, ever since its formation, has continued so distinguished for the number of its original and important memoirs, that it has yet no rival amid all the hundred scientific periodicals now publishing in Europe. To supply such memoirs as these was not indeed the ostensible purpose of its institution, but, as the introduction informs us, to communicate to the chemists of France the progress of the science throughout Europe. It is extremely probable too, that it was intended to be a powerful instrument in diffusing and establishing the principles of the modern system of chemistry. The original authors were Lavoisier, Berthollet, Monge, Fourcroy, Guyton de Morveau, Dietrich, Hassenfratz, and Adet.

In 1795, at the organization of the Institute, which now embraces every man of any talent or celebrity in France, we find M. Berthollet taking the most active lead, and the records of that Institute afford abundant evidence of the perseverance and assiduity with which he laboured for its interests. Of the committees, to which, as is the custom, all original memoirs are in the first place referred, we find Berthollet oftener than almost every other person, a member, and his signature to the report of each work stands generally first.

But indeed the zeal of M. Berthollet in the interests of science, and his anxiety to diffuse widely the truest principles by means of the press, seem to have been unremitting; for we find him not only connected, as we have just mentioned, with the establishment of journals for that end, but even looking into foreign nations, whose scientific works he always read, to select those publications among them, the translation of which into the French tongue might most advance science and benefit his country. Accordingly we find him in 1788 engaged in the translation of Kirwan's Essay on Phlogiston, and supplying it with notes of his own, in the sole view of correcting those errors which that work without such an antidote might spread. And in the same spirit, though from a different motive, we again find him, so late as 1808, superintending M. Riffault's translation of the third edition of Dr. Thomson's Chemistry, adding his own notes to the whole of it, and bringing the work under the immediate notice of his countrymen by prefixing to it an introduction. That Berthollet expected this translation to prove of

eminent service to the chemists of France, is a great compliment to our countryman, and that he was right in so expecting is well proved by the same gentleman, M. Riffault, once more translating, according to its new arrangement, the fifth edition of the Doctor's work, in 1818.

The translation of each of these works was eminently useful to science, although they were ushered into the notice of French philosophers under very different auspices. The first was accompanied by notes, refuting every one of its doctrines, and was translated that it might be overthrown: the second was accompanied by notes and an introduction, elucidating the system and supplying whatever seemed defective; and this work was translated that it might become the manual of the French chemist. Kirwan was a man who had made many chemical discoveries, some of them of considerable importance, and he was besides possessed of the power of arguing most ingeniously, accompanied, as that quality not unfrequently is, by a proneness in the heat of argument to advance propositions not resting on the most solid basis.—He remained the most illustrious disciple of the old school, and he published his Essay with the express view of defending the doctrine of Phlogiston, after he had superinduced upon it several modifications, which seemed to give it a certain adaptation to the progress of modern science. The refutation of this Essay seemed, therefore, to the French chemists to be the destruction of the last antagonist worthy of their notice. Berthollet, accordingly, in conjunction with Lavoisier, Fourcroy, Morveau, and Monge, taking the translation of the Essay, section by section, annexed to it a refutation in which the principles of the old and new schools were contrasted, and the latter triumphantly established on the ruins of the former. Lavoisier's share was the introduction and three sections, Berthollet took three sections more, Fourcroy took also three, Morveau two, and Monge one. Never was any refutation more complete; as indeed Kirwan himself was among the first to admit.

In respect to the other translation with which Berthollet was connected, the motives which dictated to him the interest he took in the work, were precisely the same, yet his treatment of it, as has been already observed, was the very opposite. Nor indeed could Berthollet at that time have given to the chemists of his country a more acceptable and useful present than was Thomson's System of Chemistry, accompanied by his own notes, and furnished with an introduction from his own pen. This work, by far the most successful of its kind which had then been attempted, was selected under the circumstances just mentioned by Berthollet, because (as he states in the introduction) it is unrivalled as a Thesaurus of every known fact of importance connected with chemistry, and as containing the most accurate account of the history of every known substance. Indeed from the extreme regularity and methodical precision characterizing the work, from the cool discrimination with which every subject is weighed and treated of according to its relative importance, and from the accurate historical detail prevailing throughout, there is at this moment no system of the science of chemistry in which so complete and extended information on every topic is to be found organized and detailed as in Thomson's Chemistry; which is evident from its having already reached the sixth large impression; and from its having long ago passed into the laboratory of the Frenchman and the German on the continent of Europe, and of the Armenian in Asia; while it has been reprinted for the use of the American student.

(*To be continued.*)

ITINERATING LIBRARIES.

These are truly useful institutions, established in East Lothian by the enlightened benevolence of Mr. Samuel Brown, and a few other indi-

viduals. Each library consists of 50 volumes, generally relating to religion, morals, history, mechanics, husbandry, geography, &c. It is sent to a village, and put under the care of some person who is willing to serve as a librarian gratuitously; and after remaining there for two years, is removed to another station. The books are allowed to be read by all persons above twelve years of age, who agree to take proper care of them. No charge is made for their use; but small fines are levied for neglecting the regulations as to returning them, and a compensation is required for any injury beyond what fair use may occasion. When one lot of 50 volumes is removed, it is replaced by another; and as there are 20 of these ambulatory lots, all of which form, as it were, sections of one parent library, and of course are never duplicates of one another, the appetite for reading is kept up by a constant succession of books which are new to the readers. Again, by adding 50 or 60 volumes to the parent library every year, the command of this variety of reading is ensured for an indefinite period. Mr. Buchan of Kelloe has established libraries of the same kind in Berwickshire, which pass from village to village, with this difference in the plan, however, that each reader pays two-pence per month, or two shillings per annum. The books in both cases have been provided from the produce of voluntary subscriptions, from individuals or societies. The plan, in its leading features, we consider excellent, and we were not aware at how small an expense, by this ambulatory method, the whole labouring population of the country might be commodiously supplied with books. We have no doubt, then, that by adopting this mode of quickening the circulation of knowledge, ten pounds may be made to go as far as a hundred expended on stationary libraries. With a very moderate sum—with an annual contribution of no more than 250*l.*—Mr. Brown thinks it would be possible to furnish two small itinerating libraries for every parish in Scotland in 20 years. By disposing these into circulating groups of 20 or 30, many a one who reaps scarcely any more advantage from the knowledge of letters than if he were born in Lapland, would, in the course of his active life, have access to 1000 or 1500 volumes, consisting of all the best standard books in the language. But to secure a permanent existence to these libraries, it is indispensable that they should yield at least a part of the funds required for their own support. A monthly payment of two-pence, or a similar sum exacted each time a volume is issued, would go a considerable way to cover the expense. Mr. Brown has also in view to circulate among the rural population, by the same means, a number of books relating specially to agriculture, and those mechanic arts commonly exercised in villages. When this is done, and when these itinerating libraries are sufficiently numerous and ample, our rural population will enjoy advantages corresponding to those which the Mechanics' Institutes have conferred on the artisans of towns. It is easy to see that the two species of institutions, with the multiplication of cheap editions and cheap periodicals, will eventually produce a wonderful change—we may rather say a great and salutary revolution, in the habits, opinions, powers, and general character of the labouring classes of society.—*Scotsman.*

METEOROLOGY.

The following statement of curious facts is taken from an excellent paper in the *Annales de Chimie et Physique* for December, which has just reached this country.

QUANTITY OF RAIN AT DIFFERENT HEIGHTS.

Since 1817 there have been at the Royal Observatory at Paris, two rain-gauges, precisely similar, one placed on the top of the edifice and the other in the court-yard. Although the difference in

the height of these two gauges is only 27 metres, about 88 English feet, the quantity of rain collected in the two is never equal, the lower gauge always collecting more rain than the upper one. From accurate observations, made ever since the year 1817, it is ascertained that the average yearly difference between these two quantities is about one-eighth part, the lower gauge collecting this quantity more than the upper one; or the upper one collected 49.551, and the lower one 56.136 *centimetres*, being an increase of one-eighth in the height of 88 feet. This phenomenon has been attributed to various causes, the most rational of which appears to be that rain-drops originating in the clouds are either increased in size as they approach the earth, by abstracting moisture from the air, or that they precipitate that moisture, as they fall, in other drops, and thus the quantity of rain is increased in proportion to the length of the column of air through which it falls. It has, however, been observed, that the difference between the quantity of rain collected in the lower and the upper gauges is not great in proportion, as the hygrometer shows the lower couches of air to be full of moisture, which seems opposed to this explanation. Though the fact is thus fully ascertained, and indeed these observations only confirm others made long ago, and at different places, on the same subject, we must say the cause is not clearly explained.

NUMBER OF DAYS IT RAINS.

The author then gives an abstract of Meteorological Journals which have been kept at Paris, with some short interruptions, for upwards of 130 years, and shows that the average annual quantity of rain which fell at the beginning of this period, viz. 1689, was the same then as now, and that there is no reason whatever to suppose that there now falls at Paris more or less rain, taking an average of the years, than there was 130 years ago. The Journals do not record the number of rainy days for so long a period. On this point they only carry us back to the year 1773; but they show that within this period, there was, taking an average of years, as many rainy days formerly as at present, and that the average number at Paris is, days of rain 140, of snow 12. Between 1689 and 1824, three months are recorded, viz. January 1691, February 1725, and January 1810, when no measurable quantity of rain fell at Paris.

The single department of the *Bouches du Rhone* offers a singular example of the influence of local circumstances on the quantity of rain which falls. At Marseilles it rains on an average fifty-five days in the year, at Arles forty-five, at Aix forty, and in the region of the *Durance* only 38, and all these places are situated within one of the 87 departments of France.

According to the observations of M. de Cesaris, the rain which fell at Milan from 1764 to 1790, was 35.5 inches in the year; but from 1791 to 1817 it was on the average 37.2 inches, whence M. Cesaris concludes that the climate of Milan is deteriorating. The author attributes this to the number of canals which have been cut in that country, and if the observation should turn out to be correct, the fact would be a curious one. It appears, however, that the observations have not been continued for a sufficient number of years to allow this question to be decided.

RAIN IN THE TROPICS.

A sufficient number of observations have not yet been made on this point to decide exactly what quantity of rain more falls in tropical climates than in others; but at Bombay it appears that the annual quantity of rain which falls may be taken as 87 inches, French measure, while the average at Paris is only 20 inches. At Bombay the rain falls only in the months of June, July, August, and September. In October, as much as 3 or 4 inches have been collected; in the other parts of the year it hardly ever rains. On July 24, 1819, there fell at Bombay

6 inches of rain, or nearly one-third of the average quantity which falls at Paris in a whole year. Captain Roussin saw 10 inches of rain fall at Cayenne on Feb. 14, in the short space of 10 hours; and in the month of February there fell 12 feet 7 inches of water, French measure, or eight times as much as falls at Paris in the course of a year. We have no examples in our climates of such a quantity of rain falling; but at Genoa, on October 25th, 30 inches of rain fell in a single day: this was occasioned by a sort of water-spout, which did not extend far.

CHANGE OF CLIMATE.

It will be seen from the following list of rivers being froze, &c. that the climate of Europe, generally, was as cold formerly as at present:—

1st Century before our Æra.—At the mouth of the Palus-Meotides the frost was so severe, that one of the generals of Mithridates defeated the cavalry of the Barbarians, precisely at the spot where they were beaten in the summer in a naval engagement. (Strabo, book ii.)

400 Years after C.—The Black Sea frozen entirely. The Rhone was frozen in its whole course. This last phenomenon indicates a temperature of 0° of Fahrenheit's scale.

462. The army of Theodomer crossed the Danube on the ice. The Var was frozen. It is now known, that this last circumstance does not take place unless the temperature of the air is at 10° Fahr.

763. The Black Sea and the Dardanelles were frozen.

822. Heavily laden wagons crossed the Danube, the Elbe, and the Seine, for more than a month, on the ice. The Rhone, the Po, the Adriatic, and several parts of the Mediterranean were frozen. This requires a temperature of —4° of Fahr.

829. The Nile in Egypt was frozen. (Abd-Allatif, translated by M. Silvestre de Sacy.)

860. The Adriatic and the Rhone frozen. (Temp. —4° Fahr.)

1133. The Po was frozen from Cremona to the sea. The Rhone was crossed on the ice. Wine froze in the cellars.

1216. The Rhone and Po were both frozen to a very considerable depth.

1234. These rivers again frozen. Loaded wagons crossed the Adriatic on the ice opposite Venice. (Temp. —4° Fahr.)

1236. The Danube remained frozen through its whole depth for a considerable time.

1292. Loaded wagons crossed the Rhine on the ice at Breysach. The Cattegat was wholly frozen.

1302. The Rhone frozen.

1305. All the rivers of France frozen.

1323. The Rhone frozen. Travellers went on foot and on horseback on the ice between Denmark, and Lubeck, and Dantzic.

1334. All the rivers of Italy and of Provence frozen. Temperature at least 0° Fahr.

1358. The snow lay 10 *brasses* thick at Bologna in Italy.

1364. The Rhone frozen at Arles to a considerable depth. Loaded wagons passed over it on the ice.

1408. The Danube frozen through its whole course. The whole sea between Norway and Denmark was frozen. Wagons crossed the Seine at Paris on the ice.

1434. It began to freeze at Paris the last day of 1433, and continued to freeze for three months and nine days. It began again to freeze towards the end of March, and froze till the 17th of April. In the same year it snowed in Holland 40 successive days.

1460. The Danube remained two months frozen. The Rhone was also frozen.

1468. The wine served out to the soldiers in Flanders was cut with an axe.

1493. The harbour of Genoa was frozen on Dec. 25th and 26th.

1507. The harbour of Marseilles was frozen throughout its whole extent. (Temp. at least 0°.) On the day of the Epiphany there fell three feet of snow in the same city.

1544. Wine cut out of casks in France with axes.

1565. The Rhone frozen over at Arles: indicating a temperature of at least 0° Fahr.

1568. On Dec. 11th, wagons crossed the Rhone on the ice; and the ice did not break up till Dec. 21st. (Temp. 0° Fahr.)

1570, 1571. All the rivers, even of Languedoc and Provence, were so frozen, that heavily laden wagons crossed them on the ice.

1594. The sea at Marseilles and Venice frozen. (Temp. —4° Fahr.)

1603. Wagons cross the Rhone on the ice.

1621, 1622. The Venetian fleet fixed by ice in the waters of Venice.

1638. The water at Marseilles froze around the vessels in the harbour.

1655, 1656. The Seine frozen from the 8th to the 18th of December. It afterwards froze on Dec. 29, and continued frozen till Jan. 28; a few days afterwards it froze again, and the frost lasted till March.

1657, 1658. It froze uninterruptedly at

Paris from Dec. 24th to Feb. 8th. Between Dec. 24th and Jan. 20th the cold was moderate; it then became excessive. The Seine was entirely frozen. The thaw, which began on Feb. 8th, lasted till the 11th; it then began again to freeze, and continued to freeze till the 18th. It was in 1658 that Charles XII. of Sweden, crossed the Little Belt on the ice, with all his army, artillery, ammunition, baggage-wagons, &c.

1662, 1663. It froze at Paris from Dec. 5th to March 8th.

1676, 1677. A very intense frost at Paris from Dec. 2d till Jan. 13th. The Seine was frozen over for 35 consecutive days.

1684. The Thames frozen at London to the depth of 11 inches; loaded wagons crossed on the ice.

1705. The Adriatic, and the harbours of Marseilles, Genoa, Cette, &c. of the Mediterranean frozen. (Temp. —4° Fahr.)

1716. The Thames frozen at London; shops established on the ice.

1726. Sledges pass between Copenhagen and Sweden.

1740. The Thames again frozen at London.

From 1749 to 1781 the thermometer never fell in Provence below 15° Fahr., and this being 15° higher than some winters previously observed, persons were disposed to conclude that the climate was ameliorated; but in 1789 this illusion was destroyed, and the thermometer at Marseilles was at 0° of Fahr. From 1800 to 1819 the thermometer in the department of the *Bouches du Rhone* never sank below 15° Fahr., but in 1820 it fell as in former severe years to 0° of Fahr. Thus, by taking long intervals, we see that excessive cold years still occur as well as formerly; and there is no reason to suppose that any considerable alteration has taken place in the climate of Provence for 1400 years.

Some further extracts from this paper will hereafter be laid before the reader.

POPULATION OF PARIS.

At page 230 of the present volume we have given some curious details regarding the state of Paris. We now add, from the *Annales de Chimie et Physique*, the following information of what is called in it the *movement* of the population for 1823. The total number of births in this year was 27,070; of these 13,752 were boys, and 13,318 girls; 5230 infants, or nearly one-fifth of the whole, were born in hospitals or other places of charity; 9806 were natural children, or born out of marriage, and of these 7585, or more than one-fourth, were abandoned by their parents.

The total number of deaths in Paris in 1823 was 24,500, and of these 8227 took place at hospitals and other places of charity; 661 were military persons, 72 died in the prisons, and 267 were deposited at the *Morgue*, a place where the bodies of suicides and of persons found dead are placed to be owned.

The whole number of marriages in 1823 was 7504; and in the same year 649 persons died in Paris of the small-pox. The fact we think most curious in this little account, as illustrative of the state of morals in the French capital, is the number of natural children, and the number of persons who are born and die in the hospitals. A third of the children are born out of wedlock, a fifth are born in *work-houses* or hospitals, and more than a fourth die there. Praise be, we say, after this, to the police-government of Paris and of France, which takes on itself the care of the national morals, and places them under the control of a cunning revolutionist like Fouché, or a jesuitical bigot like Franchet; and still more praise be to those enlightened men of England, who desire to introduce a system here which is accompanied by the bastardy of the third part of the population, the abandonment of one-fourth of all the children born, and, as a very natural consequence, the death in the hospital of one-third of all the parents.

WOOD LIES UNDER WATER.

Take two pieces of wood, planed perfectly smooth, so that no water can get between them when their smooth surfaces are put toge-

ther; cement one of the pieces to the bottom of a glass vessel, so as to have its smooth side uppermost; then place the other piece above it, and hold it in this situation till the vessel is filled with water, and it will be found to lie at the bottom as quietly and firmly as if it were a piece of lead or stone.

CAPILLARY ATTRACTION.

Procure a glass tube, open at both ends, the diameter of which does not exceed the sixth part of an inch; immerse this tube perpendicularly in water, and the water will stand an inch or an inch and a half higher in the tube than the level of the water in the vessel on the outside of the tube. This appearance is said to be occasioned by the attraction of the sides of the tube, and belongs to almost all matter. It is called capillary, from a similar Latin word signifying hair, as only small tubes like hairs have this property. On the same principle the following experiment may be explained:—

Procure two pieces of glass, about six inches square, join any two of their sides, and separate the opposite sides with a piece of wax, so that their surfaces may form an angle of about two or three degrees; immerse this apparatus about an inch in a basin of water, and the water will rise between the plates, and form a beautiful geometrical figure, called a hyperbola.

TO REMOVE SPOTS OF GREASE FROM SILK.

(*In answer to a Correspondent.*)

Take a little sulphuric ether, and wet the spot of grease with it; let the ether evaporate, and if the grease is not completely gone it must be again wet with the ether, which will have the effect of removing it without injuring the silk in the smallest degree.

TO MAKE A STONE FLOAT.

To a piece of cork tie a small stone that will just sink it, and putting it into a vessel of water, place it under the receiver of an air-pump; then exhausting the receiver, the bubbles of air will expand from the pores of the cork, and adhering to its surface will render it, together with its stone, lighter than water, and consequently both will rise to the surface and float upon it.*

A Lover of Experiment.

* Perhaps the explanation offered by our Correspondent will not be satisfactory to our readers; and they will, we hope, be induced to send us their opinions on the causes of the stone rising to the surface of the water.—Ed.

TO CORRESPONDENTS.

"R. L.'s" and "A. B.'s" communications in our next.

"J. M." Rochester, is informed, that the interpretation he put on the note in No. 43 is quite correct. It was only meant, that the fact there mentioned would illustrate the theory in question. At the same time the Editor must say, that he cannot conceive, not so much from his own knowledge, however, as from knowing the opinions held on the subject by very clever men, that the theory "J. M." alludes to is so replete with absurdity as he describes it. The question is one which relates entirely to the signification of terms; and this theory, understood in one sense, viz. that of denying something of which all men are conscious, is certainly absurd; but this is not the sense in which its author understood it, and in which it is understood by those who have most studied the subject. To be more explicit, for the satisfaction of "J. M." the Editor denies that he is an advocate for any system of the non-existence of matter, the very terms implying a gross and palpable contradiction.

*** Communications (post paid) to be addressed to the Editor at the Publishers'.

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The Chemist.

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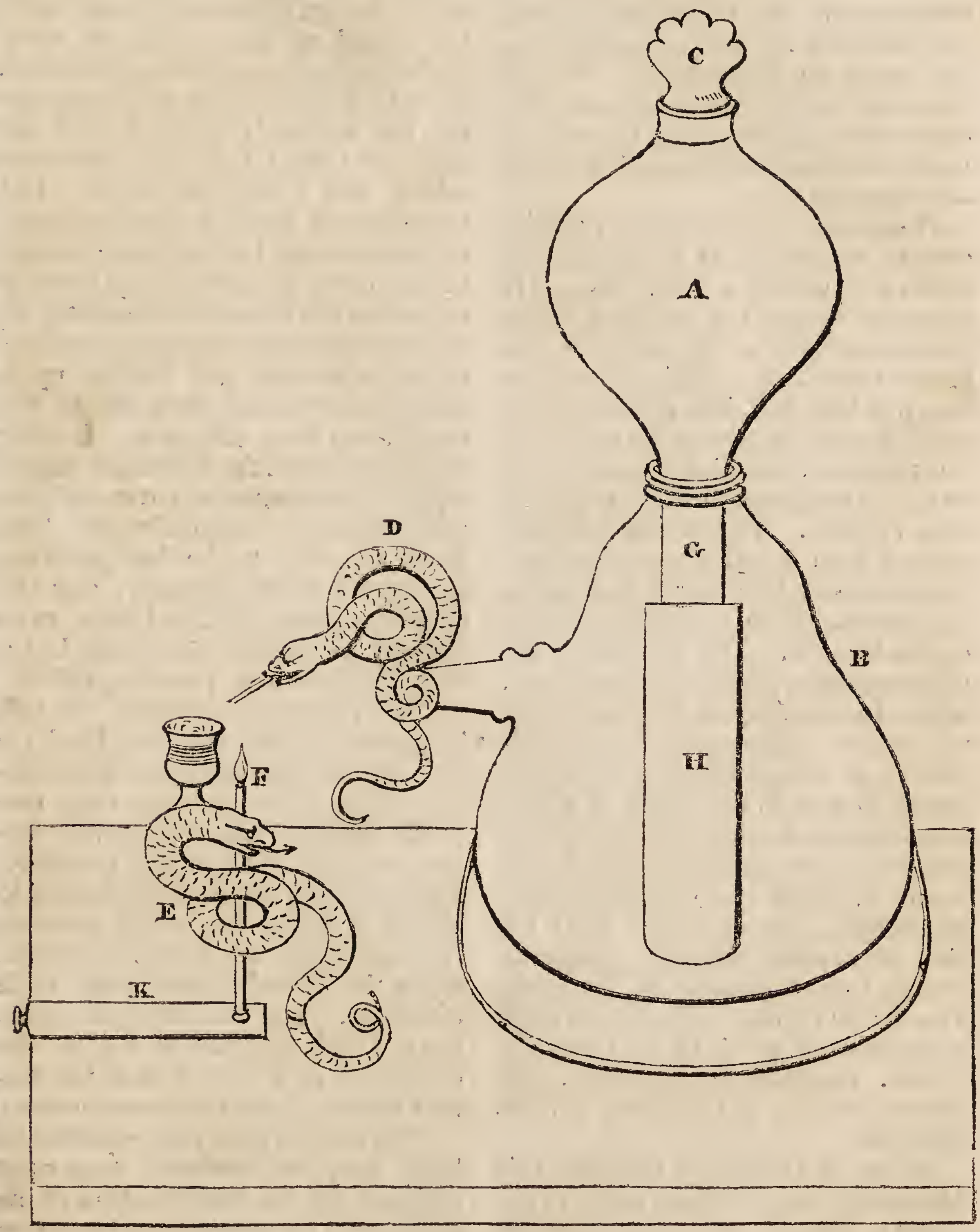

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HYDRO-PNEUMATIC LAMP.

To the Editor of The Chemist.

SIR,—Your 35th Number contains an engraving and explanation of Dr. Fyfe's Hydro-pneumatic Lamp. It is given as an example of the cheapest form in which it may be constructed, the price being only ten shillings. It may not, perhaps, be amiss to furnish you with a drawing and description of this apparatus, in the most expensive form which has hitherto fallen under my observation.

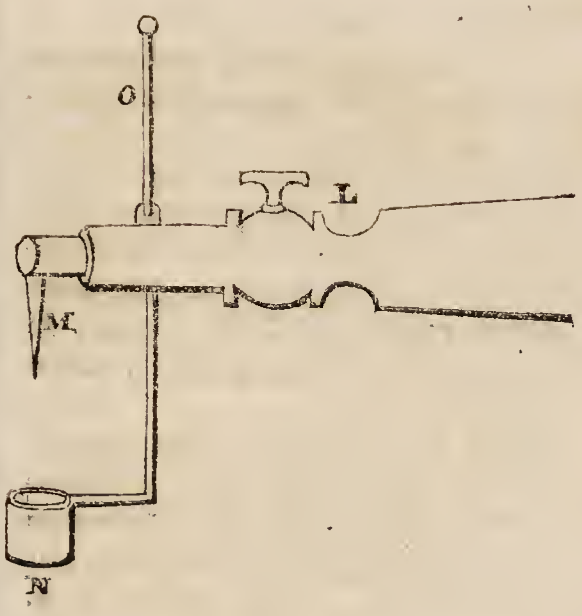
It consists of two glass vessels, one of which, A, is of a tapering form, not unlike a boy's top. Its lower extremity is ground, in order to fit tightly into the neck of the lower vessel, B. When these are first put together, it is best to oil the neck, by which means the joint will be rendered air-tight, and more easily separated when occasion may require. The vessel A is furnished with a cut glass stopper; this must not, however, be air-tight, to prevent which a small gutter is cut in its side. The apparatus for discharging a stream of hydrogen, when formed, upon the metal, by which its combustion is to be effected, is constructed of two serpents, D and E, the latter of which entwines its ample folds round the perpendicular pole F, and bears upon its head the cup containing the metal. To the vessel A is attached a glass tube G, reaching nearly to the bottom of the lower vessel: in its way it passes through a cylinder of zinc, H, by means of which, assisted by an acid, the decomposition of the water is to be effected.

When it is desired to bring this lamp into use, nothing more is necessary than to remove the stopper C, and pour in about a pint of water and sulphuric acid in the requisite proportions. Let the orifice of the lower vessel be now opened, by bending down the serpent D; this will allow the atmospheric air contained in the vessel B to escape, the liquid in the upper vessel passing down the tube G to supply its place. When it has descended, move the serpent D to an erect position, by which means all communication with the surrounding atmosphere will be cut off: the stopper C may likewise be replaced. The decomposition of the water will now rapidly take place, by the agency of the zinc and sulphuric acid, the oxygen combining with the metal to form oxide of zinc, while the hydrogen, being liberated, rises to the top. This will continue till the water is again forced up into the vessel A, by the hydrogen which has been generated. Let the serpent be now bent forward, as represented in the plate; it will then appear to dart toward the cup borne on the head of the serpent E, and the stream of hydrogen issuing from its mouth and falling upon the platinum, will first ignite the metal, and then take fire. During the combustion the hydrogen unites with the oxygen of the atmosphere, and water is reproduced. The flame appears to be issuing from the mouth of the serpent; and the serpents being gilt, and their eyes formed of rubies, the whole has a very brilliant and pleasing effect.

The respective merits of this lamp and that invented by Dr. Fyfe will not, of course, bear comparison. The latter contains only one cubic inch of gas, while the former holds many times that quantity. The one does not yield sufficient to kindle a flame, for which purpose recourse must be had to a match, while the latter obviates any such difficulty. The inequality is, however, amply accounted for by the difference of price, that of the former being, I believe, three guineas.

This form of the hydro-pneumatic lamp may be rendered somewhat cheaper by the introduction of an apparatus for propelling the gas on the platinum, of a less costly description than the one employed above.

L is a common stop-cock terminating in the jet M. When the cock is turned on, it directs the hydrogen on the platinum contained in the box N, which is moved up and down by the rod O. This reduces the price one-third.



The contriver of this lamp has furnished one to the Right Hon. George Canning: he has likewise supplied many of the public offices. It appears, indeed, well calculated for all persons who are frequently in the habit of sealing letters. The serpent E being placed on a slide K, may be easily removed, and the letter may then be placed immediately under the fire-jet, and sealed with the greatest facility.

I remain, Sir,

Your obedient servant,

Feb. 23. N. R.

LECTURES AT THE ROYAL INSTITUTION.

CHLORIDE OF CARBON. CARBURETTED HYDROGEN.

LECTURE 26. Chlorine and carbon do not produce, when brought into contact with each other, carbonic acid; and as carbon has a great affinity for oxygen, and oxygen was supposed to exist in a very loose state in chlorine, whence it had the name of oxymuriatic acid, had this supposition been true, no doubt the two substances would have acted on each other, and carbonic acid would have been formed. The two substances do not, in fact, act on each other, except we bring them together in a nascent state. When an excess of chlorine is mixed with carburetted hydrogen, there is formed, as was first discovered by Mr. Faraday, a white crystallized substance, which is chloride of carbon. It is nearly tasteless, and has an odour very much resembling that of camphor. It is insoluble in water, but soluble in alcohol and ether; most of the metals decompose it at a red heat; potassium burns in its vapour, charcoal being deposited, and chloride of potassium being formed. It is a compound of three proportionals chlorine, 108, and two of carbon, 12, and may perhaps be called a sesqui-chloride of carbon. When this compound is passed through a red hot tube, exposing a large surface to its action, chlorine escapes, and the substance is converted into a liquid protocloride of carbon, consisting of one proportional carbon and one of chlorine, and having for its equivalent number 42. There is also a third compound of chlorine and carbon, consisting of one proportional of chlorine and two of carbon. All these chlorides have a strong aromatic smell like camphor, and seem to be of little importance.

There is no binary compound of iodine and carbon; but there is a ternary compound of hydrogen, iodine, and carbon, resembling in its properties the chlorides of carbon, and which may be called hydroiodide of carbon.

CARBON and HYDROGEN, in their separate state, have no action on each other; but if these two substances are presented to each other in a nascent state, they do combine. From compounds containing the two substances, when they are decomposed, we do obtain, however, a definite chemical compound of carbon and hydrogen, called *carburetted hydrogen, hydroguret of carbon*, and *olefiant gas*. It is named olefiant gas from forming, when mixed over water with chlorine, an oil-like substance. It consists of one proportional carbon, 6, and one of hydrogen, 1, its equivalent being 7: 100 cubic inches weigh 29.7 grains. It is to air as 0.9828, and to hydrogen as 1. Two volumes of hydrogen are condensed into one, and hence, for its perfect combustion, it requires three volumes of oxygen. It is obtained in

its most pure state from distilling, in a retort, four parts of sulphuric acid and one of spirit of wine, or alcohol, and soon after the mixture boils a gas arises, which, after being washed with water, is pure carburetted hydrogen. It sometimes contains ether, carbonic acid, and carbonic oxide; the latter comes over towards the end. In this process the alcohol is decomposed, and the two elements which exist in it, hydrogen and carbon, unite, and form the carburetted hydrogen. It will not support combustion; nothing will burn in it; several substances decompose it, but always without flame. The gas is, however, itself combustible, burning with a very brilliant light; and from its combustion, carbonic acid and water result. Sulphur heated in this gas decomposes it, combines with the hydrogen, and deposits charcoal. In this change two volumes of sulphuretted hydrogen are formed for every volume of carburetted hydrogen decomposed. In combining with the carbon the two volumes of hydrogen are condensed into one, and are enlarged to their original volume when they combine with the sulphur. Carburetted hydrogen has never yet been condensed by pressure into a liquid, and must therefore be considered as having a permanent elastic form. On being passed through an iron tube, heated red hot, charcoal is gradually deposited, and the hydrogen expands to its original volume.

When chlorine and this gas are mixed over water, they act slowly on each other, and an oily matter is deposited: it is perhaps of little consequence, except as illustrating the nature of carburetted hydrogen. If we mix one volume of the carburet with two volumes of chlorine, and bring a lighted taper to the mixture, it is immediately inflamed; the carbon is deposited or flies off in intense black smoke, and muriatic acid is formed. When the gases remain mixed, and not subject to inflammation, they unite, and form an oily matter, which is probably a compound of 1 chlorine, 2 carbon, and 2 hydrogen. It is, when pure, a limpid, colourless fluid, and should be called *hydrochloride of carbon.*

Iodine and carburetted hydrogen unite, and form a compound called *hydriodide of carbon.* It is a white crystalline solid, with a peculiar aromatic smell, and analogous in many respects to the hydrochloride of carbon.

There is another gas which has been described as a definite chemical compound of hydrogen and carbon, to which the name of *bihydroguret of carbon* is applied. If there be another chemical compound of the two substances, it probably constitutes the *fire-damp* of the miners. Systematic writers describe it as having the specific gravity to air of .5616, to hydrogen of 8; and 100 cubic inches are said to weigh 16.94 grains. It is said to arise from stagnant pools, and may be collected over them. In most cases, however, the gas so collected does not seem to be a definite chemical compound, but a mixture of various gases, always varying in specific gravity and other properties. In general it is a mixture of carburetted hydrogen, or olefiant gas and hydrogen, and may be imitated by mixing hydrogen and olefiant gas of the same specific gravity. Mr. Brande said he had made many experiments on this part of the subject, and had never been able to obtain more than one definite chemical compound of hydrogen and carbon, the carburetted hydrogen, or olefiant gas.

During the distillation of coal, such mixtures as those just brought under consideration, are obtained in abundance, but of various qualities. The principal gases are carburetted hydrogen, hydrogen, sulphuretted hydrogen, ammonia, and nitrogen. For the appearance of the latter it is very difficult to account, as little nitrogen can be otherwise detected in coal; indeed, we have no evidence of its existence. The Professor here exhibited the model of a gas apparatus, explained the mode of

making the gas, and discussed the relative advantages of gas from coal and gas made from oil; all which being subjects we have either before treated of, or mean to treat of, more at large than was done by the Professor, we shall not give this part of his lecture.

DICTIONARY OF CHEMISTRY.

Gneiss. The name given to one of the rocky portions of the globe. It is of a compound nature, consisting of felspar, quartz, and mica, disposed in scales or thin strata. It is in general rich in metallic ores.

Gold. This metal having been described in another place, only requires to be mentioned here.

Gong, *tam-tam.* A peculiar kind of cymbal used by the Chinese. It has a place in chemical works only on account of the alloy of which it is made. It consists of 80 parts copper and 20 tin. The instrument is made very large, from two to three feet in diameter; the edge being turned up, so that it has the form of a flat round tub or dish, and makes, when struck, a tremendous noise.

Goniometer. An instrument for measuring the angles of crystals.

Gorgonia Nobilis, *red coral.* This curious substance is, chemically, a compound of carbonate of lime, membrane, and gelatinous matter, coloured by some unknown substance.

Goulard's Extract. Saturated solution of acetate of lead. It is used in medicine, but principally as a lubricating fluid. It is a very delicate test for carbonic acid, being precipitated by it, and has a strong attraction for vegetable colouring matter.

Gouty Concretions, *chalk stones.* Dr. Wollaston has shown that these formidable symptoms of disease are composed of uric acid and ammonia, proving the existence of a pathological relation between gout and gravel. These concretions are slightly soluble in hot water.

Grainer. By infusing pigeons' dung in water a liquid is obtained, which gives flexibility to skins, and under the name of the *grainer* is employed in the process of tanning.

Granite. One of the rocky portions of the globe, consisting of quartz, mica, and felspar, crystallized separately, but cohering into solid and hard masses, without any cement or agglutinating principle. In general it is not stratafied, like gneiss. It does not contain many metallic ores, but tin and iron are sometimes found in it, as also small quantities of some other ores.

Granite Boulders. Large masses of rolled granite, all their angles being rubbed off by attrition. They are found scattered over the whole continent of Europe, but more particularly over the northern and eastern parts, which are large sandy deserts or steppes. There is some difficulty in accounting for their origin, and various theories for this purpose have been pressed into the service of philosophers.

Granular Limestone. Some species of marble are distinguished by this name.

Granulation. The art of converting different substances into grains. It is generally done, if the substance be metallic, by pouring it, when melted, into water, or by agitating it in a box until the moment of congelation. Other substances are simply passed through sieves. Copper is granulated to make brass; and shot may be said to be granulations of an alloy, consisting chiefly of lead. Many precautions are necessary in granulating metals, and in shot manufactories the height which the melted metal falls before it reaches the water is, in many cases, not less than 100 feet.

Grape Juice. The principal substances held in solution in, and constituting this important liquid, are sugar, gum, gluten, and bitartrate of potassa. It ferments spon-

taneously at a temperature between 60° and 80°.

Graphic Ore, an ore of *tellurium*. It consists of 60 parts tellurium, 30 gold, and 10 silver, and is found in porphyry rocks in Transylvania.

Graphite, *plumbago, black lead.* Mineralogists distinguish the scaly and compact; the latter is the ore so much employed in the arts.

STARVING DISEASE.

Dr. Tronchin, a celebrated physician, who flourished at Paris in the latter part of the last century, always recommended his patients to use a spare diet, assigning as the reason for his prescription, that it cut off all the enemy's provisions, and starved him out.

GALVANIC EXPERIMENT.

Lay a live flounder on a plate of moistened copper; lay on the top of it a piece of zinc, and by means of a bended wire make a communication between the two pieces of metal, and the fish will immediately, however quiet before, become convulsed.

SUSPENSION BRIDGES.

Two of these elegant structures in iron are now forming in France: one is in the capital, a little below the bridge Louis XVI., and connects the Hotel des Invalids with the Champs Elysées; the other is on the Rhone, betwixt Tain and Tournon. The former is, we believe, to be only for foot passengers; the latter to bear wheel-carriages, although heavily laden.

CONSUMPTION IN PARIS IN 1823.

The *Annales de Chimie et Physique*, for Dec. 1824, contains the following account of the consumption of Paris for 1823:—

Drink.—	Wine	915,958	*hecatolitres.**
	Brandy	51,416	
	Cider and Perry	11,465	
	Vinegar	16,860	
	Beer	130,069	
Grapes		536,617 ½	*kilogrammes.*†
Eatables.—	Oxen	86,412	head.
	Calves	74,096	
	Sheep	363,048	
	Pigs and Wild Boars	89,562	
	Viande à la Main ‡	2,009,638	*kilogrammes.*
	Abats et Issues ‡	609,474	
	Cheese	1,351,780	
	Sea Fish sold in the market for	4,027,196	*francs.*
	Oysters, do.	889,065	
	Fresh water Fish, do.	547,119	
	Game and Poultry sold in the market for	8,037,875	
	Butter	8,463,824	
	Eggs	3,857,148	
	Hay	9,026,914	trusses.
	Straw	13,786,260	
	Oats	1,108,058	*hecatolitres.*

The quantity of flour consumed is about 1500 sacks per day; but when it is cheaper within the walls than outside of them, it amounts to 1700.

* A *hecatolitre* equals 26,419 English wine gallons.

† A *kilogramme* equals 2lb. 3oz. 5dr. avoirdupois.

‡ We are not acquainted with the exact signification of these terms; but we suppose the first, *Viande à la Main*, comprehends all that sort of meat which is brought into the town in a prepared state, and includes *bacon, lard,* and *sausages* of all descriptions; the latter, *Abats et Issues,* means, we conclude, the entrails, feet, and heads of animals.

LONDON UNIVERSITY.

Although this subject may, to some readers, appear to have little or nothing to do with chemistry, the affection we bear to every thing tending to promote knowledge, makes us regard it as worthy of being mentioned in our pages. We would fain do all in our power to promote such an establishment; but we have no other means than calling the attention of our readers to the subject, and recommending it to their notice. Several days have now elapsed since a letter, written by Mr. T. Campbell, the well-known and highly respected author of The Pleasures of Hope, &c., recommending the formation of a University in this metropolis, and addressed to that enlightened friend of every improvement in education, Mr. Brougham, was published in *The Times* newspaper. We have reason to believe that this recommendation will be acted on, and that, ere many years have passed, London will possess a first-rate university. Such a thing has long been wanted. The means of education in the higher branches of knowledge have hitherto been remarkably scanty in our country. We believe London is almost the only capital of Europe in which there is not a university; and we know that there are not two better regulated universities on the whole Continent, or any one where the students learn more, than at those of Paris and Berlin. Why, then, should London be destitute of so useful a help to instruction? We hope, now the project is started, that London will soon rival both these capitals; and that the distinguished individuals we have mentioned, as being engaged in this work, together with their liberal-ninded friends, will not cease their exertions till they have accompished so desirable an object.

INDIGO FROM WOAD.

M. Norina, an Italian, has described in the *Atti del Reale Instituti di Napoic*, (Memoirs of the Royal Institutbn of Naples,) a method by which he extracts from *woad* an indigo quite equal in quality to that obtained from the islands. The leaves of the woad are to be carefully gathered when they are quite green, rejecting all those which are in the least degree yellow or faded. They are to be steeped in water of the temperature of 78° Fahr. for about eighteen hours; at first the liquid is nearly white, but it afterwards becomes black. It is drawn off into a tub, or decanted, and after being allowed to deposit the foreign matters it contains, it is agitated violently for about two minutes: lime water is mixed with the liquid. In the course of three or four hours the dye-stuff is all deposited, and a yellow liquid is found swimming on the top of it. This is drawn off, and the precipitate, after being washed two or three times with water, is dried on filters for twenty-four hours. It is then cut into small pieces, and dried rapidly. This, M. Morina says, is indigo, as good as that which comes from the New World.

QUERIES.

To the Editor of The Chemist.

Sir,—I should feel much obliged if, through the medium of your Publication, you could inform me of a permanent green to print on cotton that needs no other rinsing than water.

2dly. Should be glad if you could inform me how a permanent red may be obtained from logwood; whether it is a substantive or an adjective colour is immaterial.

An inquiring Yout

Sir,—Will you be kind enough to insert the following Queries in your Work?

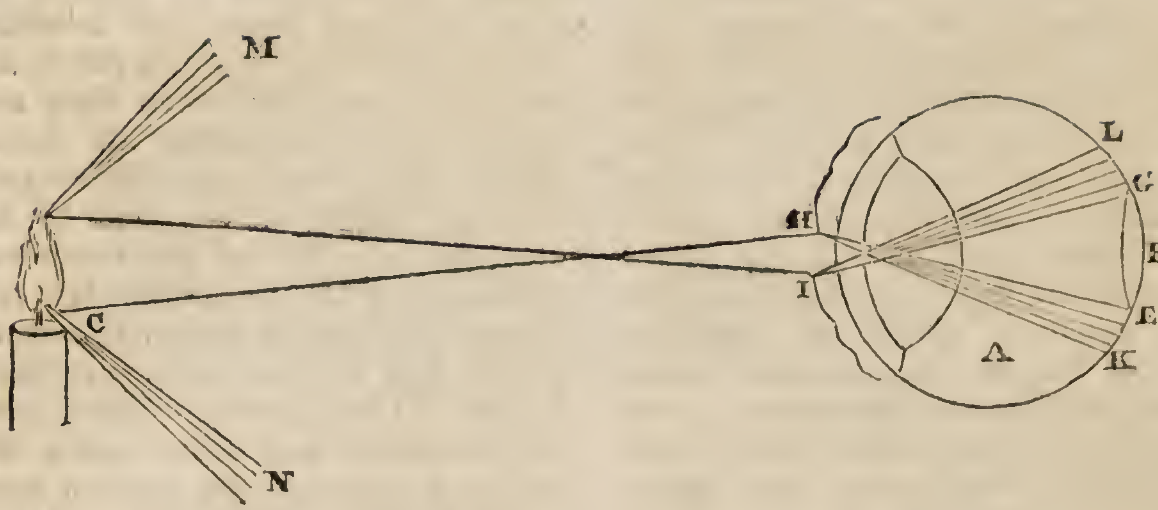
To make lycopodium.

A preparation to clean all kinds of paintings and engravings the easiest way.

A soap to take grease out of cloths, &c.

A French polish.

How to make the essential salts of lemon for taking out ink, &c. from linen.



ANSWERS TO QUERIES.

To the Editor of The Chemist.

Sir,—In answer to your Correspondent Y. Z., in page 327, I beg leave to offer to him the following solution of his query:—

In order to understand the reason of this phenomenon, let us consider the eye A, the eyelids of which, H I, are so near each other that there is only a very narrow passage left, through which the rays coming from the candle B C D pass to impress its image on the part of the retina E F G; further, it is to be observed, that the parts H and I, (which touch one another when the eye is shut,) are so smooth that they resemble two small convex looking-glasses, which reflect the rays of light falling upon them towards the retina to the parts of it E K, F L, which otherwise would not have been affected but by objects which are about B M and C N; wherefore the impression made on E K causes the appearance of bright rays, which we refer to the place B M, and the impression made on G L causes the appearance of the rays, which we imagine to be in C N.

Yours, respectfully,

Rotherhithe. R. L.

TO MAKE RED INK.

Take three pints of stale beer and four ounces of ground Brazil wood; simmer them together for an hour, then put in four ounces of rock alum, and these three are to simmer together for half an hour, and then strain it through a flannel or rag; then bottle it up and stop it down till used.

To prevent ink from moulding, it is only necessary to put a little salt therein; it will do for either black or red.

Rotherhithe. R. L.

INK FOR RECORDS.

To the Editor of The Chemist.

Sir,—As I am not aware of any set of experiments made for determining the circumstances under which alone carbon will combine with oxygen, and how far it has a power of disengaging oxygen from other substances, I shall be glad to learn from others, who have more leisure to devote to pursuits of this kind, the properties of carbon in this respect.

I was accidentally led to consider this subject, in an attempt to prepare writing-ink from ivory-black. The commissioners appointed to inquire and examine into the state of the public records, having found many of them nearly illegible, examined several persons as to the nature and qualities of the different inks now used in transcribing our modern records. The persons selected to give information, not having the slightest knowledge of chemical composition or properties of writing-ink, gave answers which, however little to the purpose, were

the only ones that could be expected. From a perusal of the crude remarks, taken down and published as evidence on the subject, I was tempted myself to make a trial whether some remedy to the evil could not be discovered. Now it is obvious, that all ink composed of a metallic oxide and a vegetable acid must perish by age, unless the metal is at its maximum state of oxidation; and as the peroxide of iron will not combine with acids, it must become disengaged from them on an exposure to any thing containing oxygen, whether it be the vegetable acid itself or the atmosphere, and the ink, of which it forms the basis, turn brown. No human device is likely ever to be able to counteract or control this necessary result of its chemical properties.

The question naturally arising from this consideration, is, whether we cannot adopt some other black pigment for the purposes of writing, into the composition of which the metallic oxides do not enter. The black colour used by painters, and the ink used by the ancients, was formed of carbon, and the colour is known to be imperishable. Would it not be proper, then, to ascertain, whether we can or not substitute it for the gallate of iron? For effecting this, the objects necessary to be obtained appear to be,—1st. To reduce the carbon to a very fine powder. 2d. To suspend it in a fluid either of its own specific gravity, or nearly of the same specific gravity, and the separation be prevented by the addition of some mucilaginous ingredient. 3d. To fix it to the paper, either by the means of a mordant penetrating the substance of it, or by some glutinous material that may attach the carbon to its surface.

1st. The first purpose is answered in making use of lamp or ivory-black, where the carbon is in a much greater state of disintegration than can be produced by mechanical means.

2d. To effect the second object, I made use of various compounds of gum dissolved in water, dilute acids and solutions of neutral salts, but without effect. The ingredients used by the ancients were, according to Pliny, lamp-black, gum, and vinegar, and the composition was effected by exposure for some time to the solar heat; but the information he has given is too scanty to enable us to prepare it. One experiment led me, however, by chance to what appeared a clue for conducting my researches. I had already tried solutions of gum and lamp-black, of all degrees of strength, and solutions of carbonate and subcarbonate of potash and lamp-black, but without success; the carbon in all subsiding, and the ink requiring to be constantly shaken before it could be used. On mixing accidentally a solution of gum, carbonate of potash, and lamp-black, I found a strong effervescence produced; and on its ceasing, that the lamp-black remained suspended, without the tendency to subside that it before possessed. From whence could arise this effervescence? Was it from any of the carburetted hydrogen that might have been absorbed and retained by the lamp-black, and disengaged by the mixture? I endeavoured to expel any gaseous body from the lamp-black that might adhere to it, but none could I detect. What then was the decomposition effected? On mixing separately lamp-black and solution of gum, or lamp-black and carbonate of potash, no decomposition ensued; and it was only on the combination of the three that the effervescence appeared. The conclusion I have drawn (and perhaps it may have been a mistaken one, but I have neither time or apparatus to enable me to verify or disprove it,) is, that the carbon used has a tendency to decompose the gum by abstracting its oxygen, but that such tendency is too weak except assisted by the presence of an alkali having an affinity for the carbonic acid formed; or in other words, that the carbon and alkali have together (what separately they do not possess) an affinity for oxygen, greater than the compound

affinities of the hydrogen and carbon, by its union with which it forms gum, and that the gum is, therefore, decomposed, and new products formed resulting from this decomposition, which are proper ingredients for a writing-ink: a similar effect is observed on preparing blacking, and attended by a like result. Perhaps these experiments, if followed up by some of your readers, may lead to further information on two points, at the first sight not very nearly allied, as subjects of inquiry:—1st. The formation of a permanent writing-ink from carbon; and 2d. An explanation of the manner in which carbon may combine with oxygen at low temperatures, and produce the phenomenon that has of late caused so much controversy—animal heat.

3d. On the third question, the use of a mordant or adhesive, I have made no experiment.

A. B.

METEOROLOGY.

TEMPERATURE OF PARIS.

THE author of the paper from which we quoted some facts in our last Number, after remarking that there was no reason to think the temperature of Provence had changed in the long period of 1400 years, goes on to examine the temperature of Paris. He shows, from a number of observations, that the thermometer must descend to 15° of Fahrenheit before the Seine freezes at Paris. In 1676 the mean temperature of December at Paris was several degrees below the freezing point; but for several years back this mean temperature has always been above this point. Within the last twenty years the mean temperature of January has never been lower than 30° Fahr.; but there is reason to believe that in 1435, 1656, 1658, 1662, the mean temperature of January, and in some of these years the mean temperature, both of February and December, were considerably below this point.—From this it is concluded, that if there is not a positive amelioration in the climate of Paris, there is at least no deterioration. The winters are not at present, as some persons suppose, more rude than formerly.

The maximum of cold observed at Paris since the year 1665, was on Jan. 25, 1795, when the centigrade thermometer stood at 23.5, or 10° Fahr. The maximum of heat noticed since 1705, was on July 8, 1793, when the centigrade thermometer marked 38° 4′, or 101° Fahr. These observations were made with thermometers placed towards the north in the shade, and as far as possible out of the influence of the reflection of the earth. If the bulbs of the thermometers had been blackened, and the instruments exposed to the rays of the sun, they would have shown a temperature above this of 16° to 18° Fahr., or the maximum of heat in the air would then be 117° to 120°. This is not, however, equal to the temperature acquired by many bodies exposed to the action of the sun; thus the sand on the borders of the sea or rivers, is in summer very often heated up to 150° or 160° Fahr. The difference between the temperature of rivers and the air is shown by this: that while a thermometer in the air at Rouen, in August 1800, showed a temperature of 100°, the water of the Seine was not above 73°.

TEMPERATURE OF THE POLE.

The author then draws, from the observations of our illustrious navigators, some information to determine the temperature of the Pole. The mean temperature of the year, as observed by Captain Parry, during his first voyage, in Winter Harbour, was about 1°; but, as he noticed on several occasions, that the neighbourhood of the two vessels raised the thermometer about 3° Fahr., the average temperature at Winter Harbour must be about —2°, which is about the degree of extreme cold experienced at Paris in severe winters. At Melville Island the mercury exposed to the air freezes spontaneously during five months of the

year. This degree of cold is not incompatible with animal life, as, during the stay of the ships at Winter Harbour, the sailors on board the Hecla and Griper killed a number of beasts and birds. It was found, too, that during perfectly calm weather a person properly clad could walk about when the thermometer was at —50° Fahr. If there was the least wind, however, the face suffered excessively from the cold, and a violent headache speedily ensued. In his second voyage Captain Parry found the mean temperature of the year at Winter Harbour was 9° Fahr., and at the island of Ingloolik, 7°. At this last place the mercury was frozen during January, February, and March; yet here the Esquimaux live through the winter in snow houses, warmed by burning blubber. From the observations made by Captain Franklin, it appears that the average temperature of the year at Cumberland House, situated in lat. 54°, long. 104° 15′, is somewhere about 30°; and at Fort Enterprise, lat. 64° 30′, long. 115° 30′, is about 15° Fahr. By comparing these observations with those made at other places nearer to the Equator, and observing the gradual decrease of the average temperature as we approach the pole, the writer in the *Annales* determines, supposing the continent of America to extend to the pole, the average temperature of this point to be —26° Fahr.; and supposing the Atlantic Ocean to extend to the pole, he concludes its average temperature will be about 0°. Taking, then, the mean of these two suppositions, he infers that —13° may be assumed as the average annual temperature of the globe at the North Pole.

At the Equator, on a level with the ocean, the thermometer has never been observed lower than 65° Fahr.; but Captain Franklin observed it at Fort Enterprise down at — 58°, making a difference of 115° Fahr.; while the difference observed between the maximum degrees of heat between Melville Island, according to Capt. Parry, and the heat observed at Madagascar, the highest we have seen recorded is only 50°. At Madagascar the heat was 115°, at Melville Island it was 60°.

In the open sea the temperature never exceeds 86° Fahr.

The author of the article concludes, that in no part of the earth at any season does a thermometer, elevated between seven and ten feet above the surface of the earth, ever rise above 116° Fahr. On the ocean, whatever may be the climate or season, the thermometer never rises to the 89th degree. The greatest cold ever observed with a thermometer suspended in the air, was — 58°; and as some bodies are cooled down lower than the air, we may suppose they might at the same time have sunk to —76°. The water of the ocean is never found in any part of the globe of a higher temperature than 85° Fahr.

FORM AN INDEX TO OTHER PROPERTIES.

To the Editor of the Chemist.

Sir,—The following fact, to which I wish to call your attention, may probably have been noticed before; but as I have never met with any one, with whom I have had an opportunity of conversing, who was familiar with it, and have never seen it noticed in the course of my reading, I am induced to think that at least it is not generally known. The shape of the leaf of the common ivy is familiar to every one. So long as the ivy is parasitical, and adheres to the wall or body by which it is supported, every leaf retains this shape; but no sooner is the shoot detached from the wall than it begins to bear amorphous leaves, all of them, however, having a tendency to get rid of their angular shape, and to subside into, what seems to me, their natural form, viz. like that of the leaf of the Portuguese laurel. Again, if you plant ivy (the Irish ivy I have tried) in the ground, taking care to remove from it every thing to which it might attach itself, the leaf is uniform, and of a shape as nearly

resembling the Portuguese laurel as may be. Now, Sir, this singularity in the ivy is worth nothing as a fact, unless we can learn something from it. It appears to me, that much may, and probably will, be learnt from it, and this is my object in addressing you. I take it for granted, as an established incontrovertible axiom, that every body in nature has a determinate form, that is, its integral molecules are all alike; and that, by combination with other bodies, these integral shapes may be changed. Take a familiar illustration. The crystals of salts in one state of combination are very different from those with the same base in another; and if the solutions of the two salts are mixed together, you obtain altogether different shaped crystals. If, therefore, the component parts of vegetables have each of them distinct forms, does it not follow, that different combinations of those parts must vary their original shapes? The ivy attached to the wall either gives out some portion of its original component parts, or receives others, so as to alter the natural combination of those which exist in the plant whilst creeping on the ground, in such a manner, that the very shape of the leaf becomes altered. And might not very nice and accurate experiments on the constituent parts of plants, and their pabulum, entirely alter our botanical nomenclature, and teach us how to classify them by their component parts? We should then get rid of the many thousand varieties which encumber our botanical system. I am inclined to think, that an investigation into these matters would teach us certainly much more than we know at present, and would, I should hope, cure us of many palpable absurdities, into which our present very limited knowledge on the subject of vegetation has led, and is still leading us.

I remain, Sir,

Yours, &c.

Ashby-de-la-Zouch, J. C.
Feb. 21.

LIFE OF BERTHOLLET.

(*Continued from p.* 363.)

Berthollet and Monge were deputed by the Directory, in 1796, to proceed to Italy, after the conquest of that country, and select those works of science and art with which the Louvre was to be filled and adorned. While engaged in the prosecution of that duty, they became acquainted with the victorious general. To know such men was to esteem them: and Napoleon had penetration enough to feel how important their friendship might ultimately prove. He therefore cultivated their acquaintance, and was happy afterwards to possess them, with nearly a hundred other philosophers, as his companions in the next expedition which he undertook.

The invasion of Egypt, which had long been regarded with a favourable eye by the French cabinet, as likely to furnish, after a few brilliant yet easy victories, a soil which should become colonized by and tributary to France, and which promised to produce rice, sugar, corn, and coffee, in abundance, to the injury of the Indian possessions of Britain, was at length, in 1798, embarked in, under the command of Napoleon, or, as he was at that time styled, the General of the Army of Italy. Interesting as the result of the expedition was to the political affairs of Europe, it was not less so to the scientific world. Many of the most illustrious names in France, in every department of philosophy, Berthollet, Monge, Andréossy, Denon, Malus, Descostils, Levavasseur, Fourier, &c. accompanied the army to that country which had been the cradle of so many useful arts and of so much knowledge, and with them the light of science once more shone on the splendid remains of ancient Egypt. In order the more effectually to co-operate in the cause of knowledge, these gentlemen formed themselves into a society named the "Institute of Egypt," which was constituted on precisely the same plan with that

of the National Institute at Paris. Their first meeting was on 6 Fructidor, sixth year of the Republic, (1798,) and after that they continued to assemble at stated intervals: on each occasion, memoirs were read by the respective members, of which, the climate, the inhabitants, and the natural and artificial products of the country they had just entered, together with its antiquities, formed important subjects. After their return to France, there was published, in 1800, a highly interesting volume of Memoirs of the Institute of Egypt,—a work to which the names above quoted were the chief contributors.

When Napoleon returned to Paris, where he enjoyed a few months of comparative leisure, amid the caresses and admiration of all ranks in the state, he resolved to employ the time of which he had then the disposal, in studying chemistry under Berthollet. It was now that this illustrious pupil imparted to the philosopher his purposed expedition to Egypt, of which no whisper was to be spread abroad until the blow was ready to fall, and begged him, at the same time, not merely to accompany the army himself, but to choose such men of talent and experience as he conceived fitted to find there an employment worthy of the country which they visited, and of that which sent them forth. For Berthollet to invite men to undertake a hazardous expedition, the nature and destination of which he was not permitted to unfold to them, was rather a difficult and delicate task, which however he earnestly undertook. All that he dared say to those whom he engaged in the enterprise, was simply, in the emphatic words of Cuvier, *Je serai avec vous;* (I shall be with you;) and never was there a more perfect proof of esteem and affection given to any individual, than those distinguished associates now freely accorded to Berthollet, in pledging themselves to encounter those dangers of which they knew nothing, but that he was to share them. But for the existence of such a man as Berthollet, who possessed at once the entire confidence of the General, and the perfect esteem and regard of men of science, it must have proved wholly impossible to unite on this occasion the advancement of knowledge with the progress of the French arms.

One of the most important essays furnished by Berthollet to the Institute of Egypt, resulted from an investigation into the nature of certain phenomena presented by the Natron Lakes in the neighbourhood of Cairo, situated on the borders of the Desert, and giving name to the Valley of the Six Lakes. The beds of these bodies of water appear to be generally composed of calcareous rock, and the water itself is more or less brackish, in consequence of the presence of a saline matter, almost entirely consisting of common salt. These lakes, although extensive, are generally shallow; and although annually filled to overflowing, they are rapidly dried up again to a large extent, in consequence of the high temperature and remarkable dryness of the climate. As the water retires, it deposits over the whole surface of the country an inexhaustible supply of hard, compact, saline concretion, consisting of a mixture of carbonate and muriate of soda. This substance contains so much of the former of these salts, that it is extremely valuable for every purpose to which that alkali can be separately applied. Accordingly, immense quantities of it are annually collected under the superintendence of government, and it is not only distributed over the country in caravans, but was at one time exported in great quantities to France, England, Italy, and other parts of Europe. The origin of this carbonate of soda was a question of much interest, but one the resolution of which was attended with no small difficulty.

The water in its original state contains little else than muriate of soda; during evaporation, a quan-

tity of this salt disappears, and is replaced by carbonate of soda. What is the cause of this change? It should seem that it must be the result of decomposition of part of the dissolved muriate of soda; yet what is the manner in which this decomposition is effected?

It was to attempt the solution of this interesting problem that Berthollet accompanied Andréossy, in the survey which that officer was taking of the Natron Lakes and of the adjacent country. Upon examining carefully the bed of the lakes, in the hope that some light might thereby be thrown on the object of his research, M. Berthollet made the important observation that it consisted chiefly of the carbonate of lime, and this led him at once to the true source of the carbonate of soda. He immediately conjectured, and was soon after enabled most luminously to demonstrate, that this salt originates in a double decomposition, which takes place to a partial extent between the carbonate of lime and the muriate of soda: it does not occur when at the ordinary temperatures water impregnated with common salt filters through the pores of carbonate of lime; but Berthollet showed in the most convincing manner that in this instance it is the effect of the peculiar situations to which these two bodies are exposed at the Natron Lakes.

The data on which he founded his opinion were extremely simple. He asserted first that there must exist a mixture of the substances carbonate of lime and muriate of soda; and this mixture cannot but be formed to a certain extent so soon as the water of the lakes has evaporated, so as to leave a part of its original bed dry. He asserted secondly, that there must exist a pretty constant though irregular moistening of this mixture with water. Experience proves this also to be the case. Under these circumstances, he showed that a portion of the muriate of soda must invariably be converted into carbonate, in consequence of a decomposition taking place between it and the carbonate of lime, the want of energy of the latter being compensated by its proportionally greater mass.

On this occasion our chemist was again greatly instrumental in teaching his country how to avail herself of one of her most valuable resources, which had nevertheless remained till now nearly unknown, and of very partial use. All the carbonate of soda consumed in her bleachfields, her glass, soap, and other manufactories in such quantities, had hitherto been constantly imported from abroad, or had been extracted from barilla, at a comparatively greater expense. Whilst, therefore, it is true that Le Blanc had the merit of first attempting in France the manufacture of this substance out of the muriate of soda or sea salt, yet it was only after the views furnished by Berthollet, after the practical application which he made of the knowledge he had acquired, that the formation of the carbonate of soda from sea salt, by processes analogous to those which nature employs in Egypt, became universally practised in that country. From that time, however, she has constantly supplied herself from a mine wholly inexhaustible, but which she knew not previously how to work, with all the immense quantity of that useful alkali which she daily consumes. To call this revenue out of what had previously yielded absolutely nothing, and from a quarter which remains for ever ready to furnish an abundant supply, is not to give a beneficial direction to commerce, but absolutely to create a national wealth. The sum of money thus annually saved to France has been computed at more than forty millions of livres. Here again the prosperity and the arts of his country seem to follow in the train of Berthollet's scientific research, and to spring up and flourish at his command.

During the whole of this expedition, Berthollet and Monge again distinguished themselves by their firm friendship for each other, and by their mutually braving every

danger to which any of the common soldiers could be exposed. Indeed, so intimate was their association, that many of the army conceived Berthollet and Monge to be one individual; and it is no small proof of the intimacy of these two savans with Napoleon, when it is learned that the soldiers had a dislike at this corporate personage, from a persuasion that it was at his suggestion they had been led into a country which they detested.

It more than once occurred in the course of the campaign, that Berthollet's courage and integrity were put to a severe test; and it is gratifying to reflect upon the manner in which he acquitted himself. It happened on one occasion, that a boat in which he and several others were conveyed up the Nile, was assailed by a troop of Mamelukes, who poured their small shot into it from the banks. In the midst of this perilous voyage, M. Berthollet began very coolly to pick up stones and stuff his pockets with them. When his motive for this conduct was asked, "I am desirous," said he, "that, in the case of my being shot, my body may sink at once to the bottom of this river, and may so escape the insults of these barbarians."

On a conjuncture when courage of a rarer kind was required, Berthollet was not found wanting. The plague broke out in the French army; and this, added to the many fatigues they had previously endured, the diseases under which they were already labouring causing the loss of the eyes and of other members, it was feared might either lead to insurrection on the one hand, or totally sink the spirits of the men into despair on the other. But Acre was not yet taken, the expedition had accomplished nothing of permanent advantage, and the general was anxious to dissemble to himself, and to conceal from his troops, the fatal intelligence. When the opinion of M. Berthollet was, however, asked in council, he spoke at once the plain and simple, though unwelcome truth. He was assailed immediately by the most violent reproaches. —"In a week," said he, "my opinion will be unfortunately but too well vindicated." It was as he foretold; and when nothing but a hasty retreat could save the wretched remains of the army of Egypt, the carriage of Berthollet was seized for the convenience of some wounded officers; immediately upon which, and without the smallest discomposure, he travelled on foot across twenty leagues of the desart.

Napoleon knew how to appreciate character; and the conduct of Berthollet, even when most contrary to his wishes, had ever commanded his esteem. Once more, therefore, they were companions in that most hazardous voyage in which Napoleon traversed half the Mediterranean in a single vessel, at a time when it was scoured by our fleet, and arrived in France to effect an instantaneous revolution in the government. Long afterwards, when he had attained to the highest pitch of power, however immersed he might be in state affairs, he never forgot his associate Berthollet. He was in the habit of placing all chemical discoveries to his account, to the frequent annoyance of our chemist; and when an unsatisfactory answer was given to him on any scientific subject, he was in the habit of saying, "Well, I shall ask this of Berthollet." Napoleon did not, however, limit his affection to these, however striking proofs of his regard; but having been informed that Berthollet's earnest pursuit of science had led him to so much expenditure as considerably to embarrass his circumstances, he sent for him, and said in a tone of affectionate reproach, "M. Berthollet, I have always a hundred thousand crowns at the service of my friends," and in fact this sum was immediately presented to him. Besides this, he was, upon his return from Egypt, nominated a senator by the First Consul, and afterwards received the distinction of Grand Officer of the Legion of Honour, Grand Cross of the Order of Re-

union, Titulary of the Senatorerie of Montpellier; and under the empire, he was created a peer of France, receiving the dignity of Count. The advancement to these offices produced no change in the manners of Berthollet; of which he gave a striking proof by adopting as his armorial distinction, at the time when others eagerly blazoned some exploit, the plain, unadorned figure of his faithful and affectionate dog. He was no courtier before he received these honours, and he remained equally simple and unassuming, and not less devoted to science, after they were conferred.

(*To be continued.*)

SOLID COPPER OBTAINED BY PRECIPITATION.

Sir James Hall has shown, that marble in a state of powder, may, under a high degree of pressure, be fused by heat, without losing its carbonic acid, and be converted into a solid mass similar to marble. Before his experiments, it was generally thought that this stone was the result of precipitation, or was deposited from some liquid. In the same manner it is now generally thought, that to obtain a piece of copper fit to be forged, it must have been fused and suffered to cool. Generally, copper, when precipitated from any solution, is in the state of a very fine powder, without any sort of aggregation. But M. Clement has lately informed the editors of the *Annales de Chimie et Physique*, that in a manufactory of vinegar from wood, near Paris, in which sulphate of copper is used in solution, that the copper is frequently deposited from this solution in a state of aggregation. M. Clement possesses specimens which weigh more than 75 *grammes*. On the part where they have been deposited they assume the appearance of the wood against which they lay, but on the exterior part they have a crystallized appearance. When filed they are very brilliant, like copper which has been melted, and their specific gravity is not less than such copper.

TO CORRESPONDENTS.

"T. H." Birmingham, is referred to The Chemist, Vol. II. pages 85 and 97, for answers to one of his questions. Spongy platinum may be procured from any operative chemist; its price we will ascertain.

"C. G." will probably find what he wants at page 303 of our first volume; his Query, however, in our next.

"T. D. S." shall receive an answer in our next.

The communication of "H.X." is received. The publisher of the work he mentions is, we believe, Mr. Limbird, in the Strand; it may, however, be procured at our own publishers', or any bookseller's.

We have attended to the request of "A Subscriber;" but having lately inserted what we think a very convenient method of consuming smoke, where water can be procured, and not having a description of Mr. Chapman's at hand, we must defer at present any account of that.

ERRATUM.

In the receipt for making blacking, in our 47th Number, there are two or three errors, which we had completely overlooked till our attention was directed to them by a Correspondent. The proportions of the different ingredients are correctly given in the French, but in turning the French weights into English we have miscalculated. The proportions should have been—

	Avoirdupois. lbs.	oz.	dr.
Plaster of Paris, 1 kilogramme,	2	3	5
Lamp-black, 2½ hectogrammes	0	8	12
Malt........5 do..............	1	1	8
Olive Oil, 50 grammes.........	0	1	12½

We hope that no other of our Correspondents but H. M. L. has suffered by our mistake; and to him we are indebted the best apology we can offer. The malt should be ground.

*** Communications (post paid) to be addressed to the Editor at the Publishers'.

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The Chemist.

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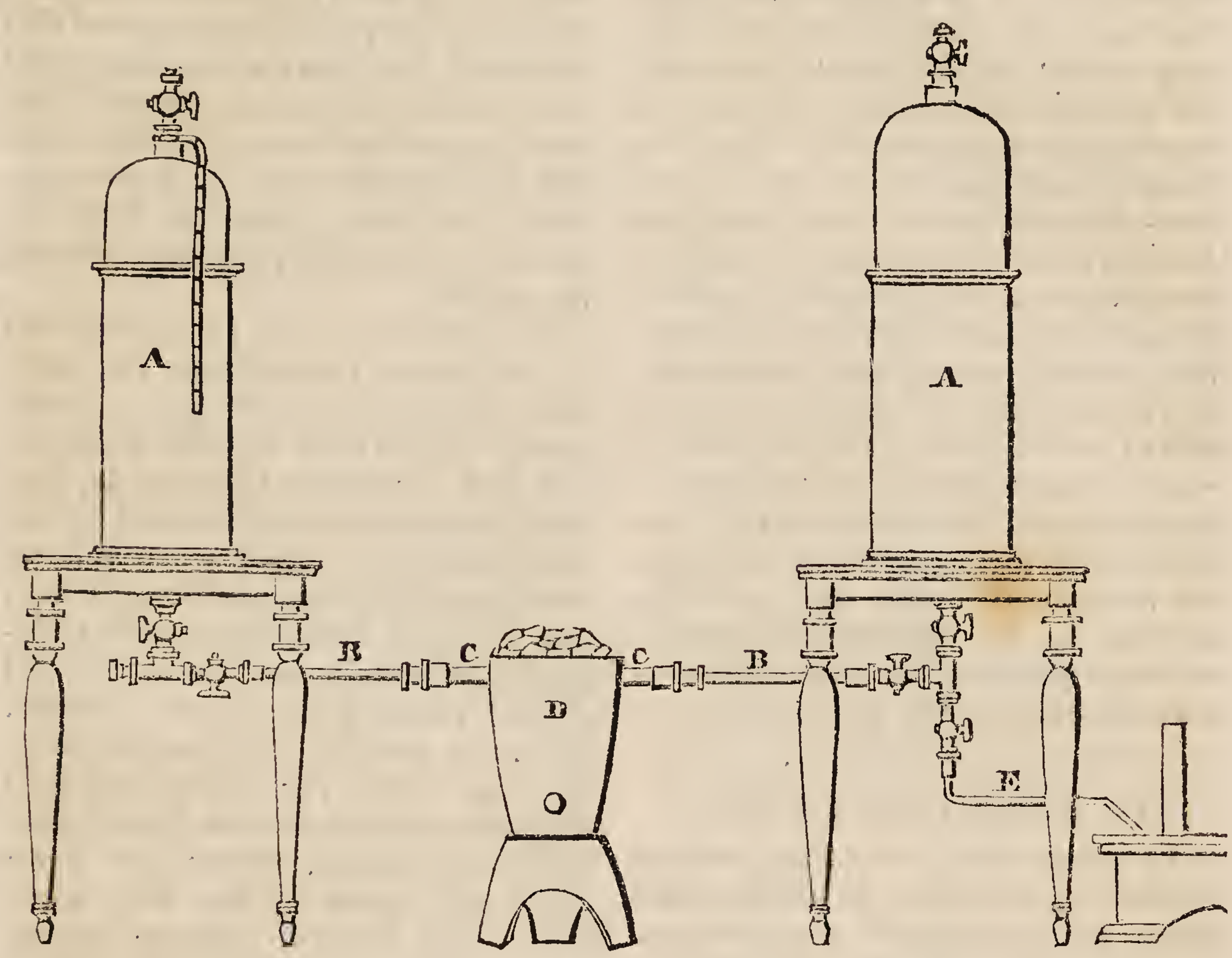

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BURNING DIAMONDS.

The plate represents the method employed by Messrs. Allen and Pepys to illustrate the products of burning the diamond. We have already described another method of doing this; but the fact is so curious, of diamond and charcoal giving the same products, that we suppose our readers will have no objection to see farther proofs of it. The apparatus employed by these

two gentlemen is described in the Philosophical Trans. for 1807.—*a a* are mecurial gasometers, one of which is filled with pure oxygen gas. The brass tubes *b b*, properly supplied with stop-cocks, issue from the gasometers; and are connected with the platinum tube *c c*, which passes through the small furnace *d*. *e* is a glass tube passing into the mercurio-pneumatic apparatus, by which the gas may be drawn out of the gasometers into convenient receivers. A given weight of diamond is introduced into the centre of the platinum tube, which is then heated to bright redness, and the gas passed over it, backwards and forwards, by alternately compressing the gasometers. Carbonic acid is soon formed, and it will be found that the increase of weight sustained by the oxygen is equivalent to that lost by the diamond; that the oxygen undergoes no change of bulk; and that the results are, in all respects, similar to those obtained by a similar combustion of perfectly pure charcoal.

TO RAISE EARLY PEAS.

It often happens that severe winters prove fatal to all the peas sown in autumn; in which case, to have an early crop, the seed is sowed in hot-beds, and the plants raised by artificial heat; they are then transplanted into the common soil. Mr. Knight, the President of the London Horticultural Society, has described his method of accomplishing this object, which is as follows:—On March 1st, the ground being previously prepared, part of the seed was sown as usual in rows, where the plants were to remain; at the same time, other peas of the same early kind were sown in circles within the circumference of pots ten inches in diameter. These pots were filled with a compost made of equal parts of thin turf, to which much lifeless herbage was attached, and unfermented horse-dung without litter, and a quantity of ashes of burnt weeds, containing a good deal of burnt mould, equivalent in bulk to about one-twelfth of the other materials. Equal parts of fresh soil, with unfermented horse-dung with litter, and a small quantity of quick lime or wood ashes, would probably operate as powerfully as the compost above described. The whole was reduced to fragments, and well intermixed. The pots were filled with it to within an inch of their tops: on the surface of this compost the peas were sown, and covered with common mould. The pots remained in the peach-house till the plants were an inch high, they were then removed into the open air, but were protected during the nights.

In the last week in March the plants were taken from the pots and planted in rows in the ground; nearly the whole of the compost adhered firmly to their roots, and their growth was not checked by the transplanting. They were placed contiguous to those previously sown, and a small quantity of the compost was added, and then the soil closed round their roots. Sticks, &c. were provided in proper time. On April 29th, the plants sown in the pots were 15 inches high, while their neighbours, which had been originally sown in the soil, were only four inches. These plants produced their fruit 12 days earlier than the others, and gave a more rapid succession of crops. Mr. Knight attributes this partly to the heat of the unfermented dung; it having been often observed, he says, that snow does not lie so long on ground manured the previous season with fresh unfermented horse-dung as on ground not manured, showing that the manure retains or produces a considerable degree of heat, though it may not be sensible to the touch of a warm-blooded animal; partly to the stimulant nature of the compost, and partly to the favourable state of the soil in which they were placed, as peas never thrive in strong soils, particularly when it has been pressed down and soddened by rain.

LECTURES AT THE ROYAL INSTITUTION.

CYANOGEN. BORON.

LECTURE 27. In continuing the subject of carburetted hydrogen, with the consideration of which the last lecture terminated, Mr. Brande explained the principles of the safety-lamp, and repeated his account, somewhat more in detail, however, of the mode in which Sir Humphry Davy had been led to the discovery. As both these subjects have been lately mentioned in our pages, we shall only very briefly advert to what the professor now said. The power of the wire gauze arises from the metal being so good a *radiator* or dispenser of heat; it was first observed that flames did not pass through tubes of a certain dimension and of a certain length, and gradually reducing the length, wire gauze was at last adopted, which may be considered as an indefinite number of very short tubes. The metals which radiate best are the best for this purpose; and the gauze is usually made of iron or copper, but the former is the better of the two. The safety-lamp is only a common oil lamp, surrounded by a screen of wire gauze; there is a very small tube passing from the under part of the lamp, through which a small wire enters to trim it, but this tube is so small that no explosion can take place through it. If through any neglect a mesh of the gauze is broken, or there are any apertures larger than the ordinary size, it is not safe, and the accidents which have occurred when using it may have arisen from a neglect of proper precautions. The lamp when used should be carefully examined every day, and it should be ascertained that it is not broken in any part, and that it is firmly screwed on to the bottom. The top of the lamp is usually doubled, to make it less liable to accidents. When the lamp is in good order it well deserves its name, and is perfectly safe. To illustrate this, Mr. Brande placed one lighted within a large bell glass, into which there flowed a stream of coal gas. On this gas filling the whole glass and forming its atmosphere, of course it penetrated within the gauze of the safety-lamp, where it burnt with a pale blue flame. At this time the atmosphere of the glass was explosive, as was proved by applying a lighted taper to it, when it instantly exploded, blowing off the top, and prior to this no explosion took place; the safety-lamp, therefore, continued to burn amidst an explosive mixture without setting it on fire. It not only gives the miner a light without subjecting him to danger, but it also tells him when danger is near. Air which catches fire within the lamp is still respirable; and thus when this occurs the miner is warned, while there is yet time to escape from the fatal spot.

Many methods have been pointed out for the analysis of inflammable gases; but the following mode, Mr. Brande said, he had always found sufficiently accurate and easy for most practical purposes. Let us suppose the gases a mixture of carbonic acid, hydrogen, carburetted hydrogen, and carbonic oxide, then the way to proceed is this: introduce a given quantity, say 100 measures of the gas, into a graduated tube, and then let up into it a solution of potassa, which absorbs the whole of the carbonic acid, the quantity of which may be known by observing what quantity of gas remains. Transfer the remaining gas to another tube standing over water, into which admit three times its volume of chlorine of a known purity; and its purity may be known by agitating it with water, and if pure it will be all absorbed. Expose the mixture of chlorine and the gas to be tried to the action of light, but not to the direct solar ray, and at the end of 24 hours the whole of the carburetted hydrogen and the excess of chlorine will be absorbed. The diminution being noted, we obtain the quantity of carburetted hydrogen. The remaining mixture of hydrogen and carbonic oxide may be mixed with an excess of oxygen, and deto-

nated, and the quantity of carbonic oxide determined by the quantity of carbonic acid which will remain, the latter being always equal to the original carbonic oxide. Dr. Henry has recommended another method; but for common purposes this, Mr. Brande said, he had always found to answer very well.

Carbon and nitrogen unite and form *carburet of nitrogen*, or cyanogen. For our knowledge of the true nature of this compound we are indebted to the experiments of Gay-Lussac on prussic acid, the base of which he discovered to be this peculiar compound, and gave to it the name of cyanogen. By some English authors, particularly Dr. Ure, it has been called *prussine*, from its forming the base of prussic acid. Cyanogen is derived from one of its properties, and signifies generator of blue; its name, carburet of nitrogen, expresses its chemical nature. It is obtained by exposing *prussiate* of mercury to a gentle heat in a retort; part of the prussiate passes over and crystallizes, while at the same time a gas arises which must be collected over mercury, and is carburet of nitrogen. It is a gas of the specific gravity, compared to air, of 18 to 10, to hydrogen of 26, and 100 cubic inches weigh 55.06 grains. Water absorbs about four and a half volumes. At a temperature of 56°, and under a pressure of four atmospheres, as ascertained by Mr. Faraday, it is condensed into a limpid liquid. To accomplish this it is only necessary to generate it in a retort, and collect it in a sealed tube, which is kept very cold by freezing mixtures. It has a strong pungent smell, resembling that of bitter almonds, which, in fact, have been found to contain a quantity of prussic acid or cyanogen united with hydrogen. It is inflammable, but extinguishes a taper, and burns itself with a bright purple flame, giving for the products of combustion, nitrogen and carbonic acid. The same results are obtained by mixing it with oxygen, and detonating it over mercury. Every volume mixed with two volumes of oxygen produces two volumes of carbonic acid and one of nitrogen. It is a compound, therefore, of two volumes of carbon = 12, one of nitrogen = 14; or it is a carburet of nitrogen, having for its equivalent 26. The nitrogen uniting with the carbon suffers no change in bulk, so that the bulk of the compound equals the bulk of the nitrogen. Alcohol absorbs 23 times its own volume of this gas; but neither this nor the aqueous solution are permanent, for both are subject to spontaneous decomposition, being gradually converted into carbonic and hydro-cyanic acids, ammonia, a peculiar acid called cyanic, and a brown substance containing carbon, which has not yet been examined; the ammonia saturates the acids, and this brown substance is deposited.

Cyanogen and chlorine unite to form chloro-cyanic acid. Mr. Brande said he did not exactly understand the method which had been recommended to obtain this acid; but Gay-Lussac had procured it, and described it as consisting of one proportional cyanogen, 26, and one of chlorine, 36, equal to 62. It is a very volatile liquid, having a peculiar and irritating odour. 100 cubic inches weigh 65.64 grains. It is a compound of no importance or interest. The same may be said of *iodocyanic* acid, which may be formed by heating iodine with *cyanuret* of mercury; and both compounds are only mentioned from this being their proper place in the arrangement, not from their value.

With hydrogen cyanogen combines, and forms *hydrocyanic*, or prussic acid. Formerly this triple compound was obtained from prussian blue, or prussiate of potash, but is now obtained by a method discovered by Gay-Lussac. It is necessary to caution every body in using this substance, as inhaling the vapour is very disagreeable and injurious; and this, Mr. Brande said, together with the time it would occupy, were the reasons why he did not make the experi-

ment. Prussiate, or *cyanuret* of mercury, is to be put into a retort, into the neck of which a quantity of pounded marble is placed, and a phial as a receiver adapted to the end of it, which is to be kept cold by a mixture of ice and salt. The cyanuret is to be moistened with muriatic acid, and a gentle heat applied. Hydrocyanic acid arises in vapour, and is condensed in the phial, while any muriatic acid which comes over is stopped by the marble setting at liberty carbonic acid, the presence of which in the hydrocyanic acid is of no consequence. In manufacturing the acid on a large scale, a long tube should be employed, and chloride of lime used to arrest the carbonic acid. Thus obtained, it is a very volatile liquid, causing, by the evaporation of one part, a great deal of cold, so as to congeal the remaining portion. It has an intense smell, like bitter almonds; its taste is very acrid, and it is very poisonous. Even largely diluted with air, it is very deleterious, and, undiluted, a single drop placed on the tongue of a large dog, instantly destroys it. The nervous system seems affected, and death ensues even before the action of the heart has ceased. It is, perhaps, the most powerful poison known. It has a specific gravity of 7, compared to water, 10. It boils at a temperature of 80, and at 3 becomes solid. It reddens litmus paper, and is called an acid from combining with the bases. It is used in medicine, and is prepared of different strengths for this purpose: the acid may be either diluted with water, or it may be distilled over with water. One pound of cyanuret of mercury mixed with six pints of water and one pound of muriatic acid is put into a retort, and six pints are distilled over, when an acid solution is obtained of a specific gravity of 0.995. As it suffers decomposition if kept, only small quantities should be prepared at one time. Hydrocyanic acid is a compound of 1 cyanogen and 1 hydrogen, equal to 2 volumes carbon, 1 nitrogen, and 1 hydrogen. Its equivalent number is 27. Its vapour, as compared with hydrogen, is of the specific gravity 13.5, to air as 0.9447; and 100 cubic inches weigh 28.57 grains.

The essential oil of almonds contains this acid, and is much used by cooks and perfumers, as a substitute for bitter almonds,—a practice to be reprobated, as it is a strong poison in whatever state it exists. On some people its effects are more active and dangerous than on others; and eating a single bitter almond gives rise in them to serious agitations. The poison seems to act wholly on the nervous system, and even after respiration has been suspended, if it be kept up by artificial means, and the action of the heart be not stopped, life may be preserved.

Cyanogen and sulphur form a compound, which has been called *sulpho-cyanic* acid. It is of no interest except as a test for iron. With solutions of the peroxide of this metal, it forms a red-coloured precipitate; with the salts formed of the proto-oxide it produces no effect. Hydro-sulpho-cyanic acid, and a compound of cyanogen and phosphorus exist, but have not been examined.

Sulphur and carbon form sulphuret of carbon, a compound which was discovered by Lampadius, who called it alcohol of sulphur. It is obtained by passing sulphur over red hot charcoal, or by putting charcoal and sulphur in an earthen retort, and by the application of heat a liquid distils over, which must be condensed in a receiver surrounded with ice. This is liquid sulphuret of carbon, holding sulphur in solution, which is deposited after a time. Care must be taken to regulate the temperature, for if this be too high the sulphur sublimes over. It has a specific gravity of 12, is volatile, and boils at 106°: it does not freeze at the temperature of —60°. By its evaporation an intense degree of cold is produced, and by surrounding the bulb of a thermometer with cotton moistened with

sulphuret of carbon, and exposing it to the air, we may freeze the mercury, as was first shown by Dr. Marcet. It has the odour of sulphuretted hydrogen, and burns readily, the products being sulphurous and carbonic acids. It was supposed to contain hydrogen, but as no water can be obtained by its combustion, this opinion is now given up. It is a compound of 2 sulphur and 1 carbon, its equivalent being 40. It is of no importance.

Phosphorus and carbon do not combine.

Boron, the last of the electro-positive bodies to be examined, is little known, and is only to be obtained from boracic acid, of which it forms the base. It is a body of no importance, except as forming boracic acid, and that constituting with soda the salt called borax, which is of great use in the arts, particularly in metallurgical operations. This falls afterwards to be examined. At present, said Mr. Brande, in concluding his lecture, having terminated all my remarks on the electro-positive and electro-negative classes of bodies, I shall take leave of you, delivering you over to Mr. Faraday's care and instruction, who will explain to you the chemical history and properties of the metals, and I shall again meet you hereafter, to treat the subject of vegetable chemistry.

DICTIONARY OF CHEMISTRY.

Grauwacke, *greywacke*. The name of a mineral formation, being a species of slate, having fragments of rocks and other substances embedded in it. There is much of it in Britain, and it contains metallic ores, both in beds and veins.

Gravel. The name given to a disease, to the substance emitted with the urine during that disease, and to a mineral. The urinary gravel, when white, consists of phosphate of lime and ammoniaco magnesian phosphate; when reddish, is chiefly uric acid.

Gravel. The mineral is found in great abundance in the neighbourhood of London, which is a great basin of this and other alluvial deposits. It contains, mixed with it, quantities of fossils, and is thought to afford evidence of having been repeatedly under both the sea and fresh water.

Gravity. The tendency which bodies have to fall towards the centre of the earth.

Gravity, Specific. The relation in which all bodies stand as to their tendency to fall towards the centre of the earth, or to some other body chosen as a standard. For solids water is the standard referred to; for gases hydrogen is assumed as unity.

Green-Earth, *mountain-green, green-earth of Verona*. A pigment used in water-colour painting. It is a durable colour, but not so bright as the pigment from copper. Its component parts are, silica 53, oxide of iron 28, magnesia 2, potash 10, water 6.

Greenstone, *diabase*. A rock of the trap formation, consisting of hornblende and felspar in the state of small crystals.

Green Vitriol, *sulphate of iron*.

Grenatite, *prismatoidal garnet, staurotide, staurolite*. A dark red garnet, consisting of alumina 44, silica 33, lime 3.84, oxide of iron 13, oxide of manganese 1, loss 5.16.

Guaiacum. A resinous looking substance, obtained from the wood of the *guaiacum officinale*, a tree growing in the West Indies. It is used as a medicine.

Guano. A curious substance, found on many of the small islands of the South Sea, which are much frequented by birds. It is dug from beds that are many feet in thickness, and is used as a manure in South America. It contains uric acid saturated with ammonia and lime, and is supposed to be formed from the droppings of the birds.

Gum. The name of one of the secondary principles or substances found in vegetables. It is contained in the sap of vegetables, and sometimes exudes from them spontaneously. There are various

species of gum, as those obtained from the plum, peach, and cherry trees; *Gum Arabic*, the spontaneous product of the *acacia* in Egypt, Arabia, and other countries; *Gum Senegal* resembles gum arabic; *Gum Tragacanth*, obtained from a plant of this name, &c. &c. Gum has a slightly yellow tint, is translucent, inodorous, and insipid; it dissolves in water, and is insoluble in alcohol.

Gum, Elastic. *Caoutchouc.*

Gummate of Lead. Gum unites with oxide of lead, and forms a substance which has been called gummate of lead.

Gum Resins. Natural combinations of the two vegetable principles, gum and resin: frankincense, scammony, asafœtida, &c. &c., are all gum resins.

Gunpowder. A well-known explosive compound, consisting of different proportions of nitre, charcoal, and sulphur, intimately blended together; the most effectual proportions, however, to give force, are 75 parts by weight of nitre, 16 of charcoal, and 9 of sulphur.

Gypsum, *sulphate of lime*. A mineral genus, of which there are two species and several subspecies. It is abundantly distributed in many parts of the world.

SMALL BALLOONS.

To the Editor of The Chemist.

Sir,—I doubt not but the following communication will be acceptable, as the articles to which it relates are sold at a very high price, and they may be easily made by those who choose to give themselves the trouble. The small balloons sold at most of the philosophical instrument makers are manufactured from the crop or stomach of the turkey, which, when distended, will contain several pints of air. They may be procured at any of the poulterers', as they are usually thrown away with the rest of the entrails. Now for the process: First take the crop and free it from the thick coat of fat which usually envelopes it; then turn the inside out, and wash the food out which it usually contains; soak it in water for a day or two, until it becomes a little putrid, or rather high, then lay it on a cloth, and with a bone or wood knife scrape off the inside coat of the stomach; wash it, and dry it with a clean cloth. Now turn the crop, and begin the outside by first making a slit on the outside coats of the crop, as far through as the membrane which has been cleaned on the inside, taking care not to tear it. Draw the coats at once over the neck, which must be cut long for greater convenience in using the balloon when finished: proceed with the other neck in the same way. Tie it firm with silk, and cut it off close up to the body of the balloon. With a little care and practice the skin may be easily drawn off the other parts of the crop. It must then be distended with wind, and hung up in that state to dry. When dry and filled with hydrogen gas, if proper care has been used, it will be found to ascend, and remain up for several hours. I have made them so large as to contain a gallon of gas, and so light as to weigh only thirty grains, and carry up two or three small corks when filled from a common gas burner. They may likewise, if necessary, be varnished and painted, but will, if well prepared, need no varnish. Should this meet your approbation, you may perhaps hear from me again.*

I am, &c.

H. X.

VEGETABLE CHIMNEY ORNAMENTS.

In winter an elegant chimney ornament may be formed, by cutting the head or thick end of a carrot, containing the bud, and placing it in a shallow vessel with water. Young and delicate leaves unfold themselves, forming a radiated tuft of a very handsome appearance, and heightened by contrast with the season of the year.

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* We shall be glad to hear again from our Correspondent.

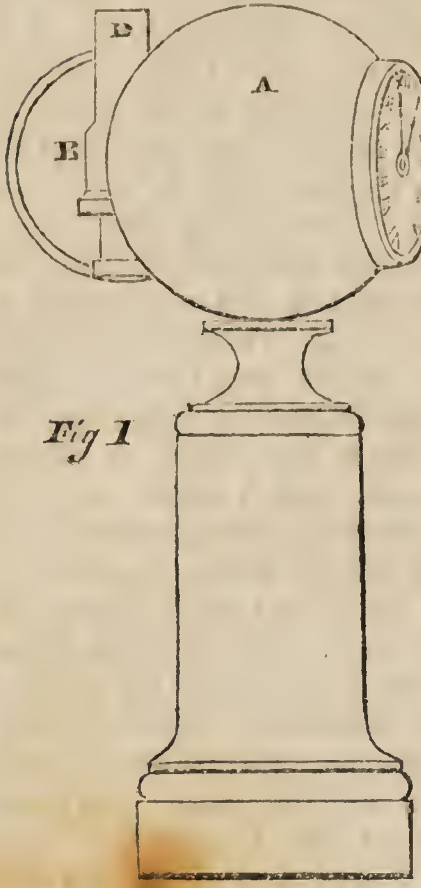
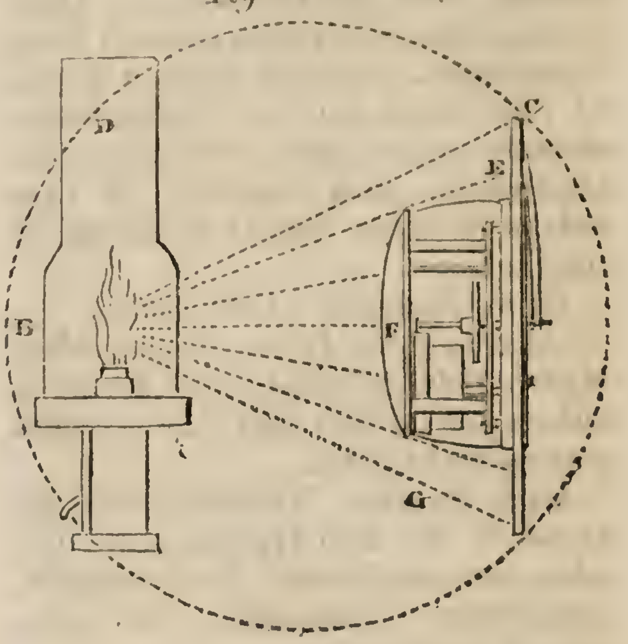


Fig 1

Fig 2.



ILLUMINATED CLOCKS.

The plate is a representation of M. Griebel's night clock or watch, which, we are informed, is much in use at Paris, and makes a handsome ornament, as well as being of considerable use. Fig. 1 represents the lamp and its pedestal; fig. 2 is a view of the clock and the lamp; A is the globe in which the machinery of the clock and the lamp B are both enclosed; C is the face of the clock, made of ground glass, on which the hours and minutes are painted; D, lamp-chimney; E is a plate occupying the centre of the transparent part, and serving to regulate the movement; F, a globe protecting the works of the clock from dust; G, rays of light falling on the face of the clock on which the hours and minutes are marked; the remainder of the face is concealed by the plate E. There is nothing visible at the face but what we wish to see. The lamp is placed so far from the machinery of the clock that the heat has no effect on it. The whole forms a handsome ornament; and the principle may be applied to carriages, the lamp throwing its light outside, as well as showing the hour within.

FLINTS.

To the Editor of The Chemist.

Norwich, Feb. 2.

Sir,—In the course of my rambles through the suburbs of this city, I have observed on a bank some flints, the fractured sides of which are coated with a very thin light blue colour, which is nearly semi-transparent. Anxious to discover the cause of this phenomenon, I soon convinced myself that it was produced by natural means; but if any of the readers of your useful little work could inform me what those natural means are, it would much oblige

Your constant reader,

H. R.

[We received some time ago a communication on this subject, which we laid by to insert at a convenient opportunity, and now meant to have done so, but we cannot find it. Perhaps the author of that ("A Stone") will favour us with his opinion on the present occasion.—Ed.]

LIFE OF BERTHOLLET.

(*Concluded from p. 384.*)

In 1803 Berthollet published his work on Chemical Statics. Lavoisier had established almost nothing positive or precise with regard to chemical affinity, and it remained a topic which few cared to assay, on account of its difficulty, until the researches of Berthollet, at the Natron Lakes of Egypt, suggested to him a train of new ideas on the subject. In this work Berthollet explained his ideas of chemical affinity, which led him into several controversies, and being at present generally given up, are perhaps not worthy the attention of our readers.

It was the prevalent idea, previous to this period, that the putrefaction which water always undergoes after being long kept in wooden casks, and which so greatly injures its taste and smell, is the effect of an inherent principle which accompanies the liquid from the spring. Berthollet, however, conceived the cause of this putrefaction to be *the solution of an extractive matter from the wood*, and that this might be prevented by charring the inside of the cask. This process would possess the double advantage of wholly excluding the water from the wood on the one hand, whilst the antiseptic qualities of the carbon must check any putrefactive tendency in the water, whatever might be its origin, on the other. He accordingly took two casks of the same materials, charred the interior of one, and filled both with water. At the end of four months, the water in the charred cask had contracted no unpleasant taste or smell whatever, while the water in the other was become so putrid, that its very smell was intolerable.

Not long afterwards, the celebrated navigator Krusenstern, having seen a statement of this mode of preserving water quoted in a periodical journal, immediately put it in practice with a portion of his water casks, and after a few months' experience, he subjected them all to this process. The comfort which he enjoyed from it he mentions in a letter to a scientific friend, dated Kamschatka, July 8, 1805:—"Our water (says he) has been constantly as pure and good as that of the best spring. We shall thus have had the honour of being the first to put in practice a process so simple and so useful, and the French chemist will perhaps receive pleasure from learning the happy issue of the method he proposed."

It has also been found of as much benefit to char the interior of casks in which wine is kept, as of those for containing water. Wine possesses also the property of dissolving an extractive matter from the wood, which injures its flavour, and peculiarly exposes it to the acetous fermentation. It is in consequence of this, that *well-seasoned* wine casks are much preferable to *new;* but, for the same reason, charred casks are much preferable to either. Berthollet himself was the first to suggest this application of his process, and at his request, M. Paris, an intelligent wine merchant, put his proposal to the test of experience. In a few years he wrote to inform M. Berthollet that the wine preserved in these casks was more rich and generous than it could have been under any other treatment. It is really difficult to say whether M. Berthollet is most to be admired for the profoundness and originality of his scientific views, or for his tact and felicity in applying discovery to useful practice.

As we advance towards the latter periods of the life of Berthollet, it is delightful to find, even under his silver hairs, the same ardent and unremitted zeal in the cause of science, which had glowed in his earliest youth, accompanied by the same generous warmth of heart that he had ever possessed, and which displayed itself in his many intimate friendships still subsisting, though now mellowed by the hand of time.

At this period, La Place, beyond comparison the profoundest astronomer and mathematician of his day, lived in or near Arcueil, a small

village situated three or four miles from Paris. Between this great man and Berthollet, there had long subsisted a warm affection, founded on mutual esteem. In order, therefore, to be near each other, and enjoy the more frequent intercourse, the chemist purchased a country-seat in the village. Here he established a very complete laboratory, fit for conducting all kinds of experiments in every branch of natural philosophy; and there soon flocked around him a number of distinguished young philosophers, most of whom had been the pupils of Berthollet, and who knew that in his house their ardour would at once receive fresh impulse and direction from the example and counsels of their former instructor; while at the same time they should be readily supplied with the means of conducting those experiments in which an expensive apparatus was requisite.

Among the most assiduous and successful of these young men was A. B. Berthollet, the son of the illustrious chemist. He had already rendered no small service to his countrymen, by the zeal and assiduity with which he had co-operated with his father in preparing and publishing a new and greatly improved edition of that valuable work, the Elémens de l'Art de la Teinture. The names of the father and son stand together on the title-page as joint authors, and the natural affection which must ever subsist between two persons connected by so intimate a degree of relationship was in their case strengthened and exalted by a community of feeling, and by kindred pursuits. To the chemical world in general the younger Berthollet is well known, by his discussion with Proust respecting the constitution of hydrates and metallic oxides; by his memoir on ammonia, in which he combated successfully an opinion of Davy's, and established the general accuracy of his father's previous analysis; by his essays on the chloride of sulphur, and Lampadius's alcohol of sulphur.

Surrounded by a company of youthful philosophers like these, it occurred to Berthollet that their organization into a Society would introduce a method and regularity into their researches, which, whilst it must be delightful to the individuals themselves, could not fail to advance materially the cause of science. This was the origin of the celebrated Société d'Arcueil, which unfortunately was as short-lived as it was illustrious. M. Berthollet was himself the President, and the other original members were La Place, Biot, Gay-Lussac, Thenard, Collet - Descostils, Decandolle, Humboldt, and A. B. Berthollet. In this class, we find respectively the most distinguished men in astronomy, mechanical philosophy, chemistry, and botany, which France or Europe could boast of, and the traveller Humboldt belonging to no class in particular, but the profoundness of whose views equals the universality of his knowledge.

It is severely painful to learn, that the energy of this Society was soon paralyzed by an event which embittered the latter days of the life of Berthollet, even then, when all seemed to promise it a quiet and a tranquil end. His promising son, in whom his happiness was wrapped up, was unhappily subject to the fearful malady of despondency, which at length grew upon him to such a degree that neither the rank and fame of his father, nor the affection of his aged mother, nor the respect of friends, nor the honours which science seemed to hold out to his young years, could prevent it from gaining a gloomy mastery over his soul. He grew weary of his existence, and at length his life became wholly unsupportable. Retiring to a small room; he locked the door, closed up every chink and crevice which might admit the air, carried writing materials to a table, on which he placed a second watch, and then seated himself before it. He now marked precisely the hour, and lighted a brazier of charcoal beside him. He continued to note

down the series of sensations he then experienced in succession, detailing the approach and the rapid progress of delirium, until, as time went on, the writing became confused and illegible, and the young victim dropped dead upon the floor!

After this event, the spirits of the old man never again rose, for the spring of his hope was broken, and the stay of his age was gone. Occasionally some discovery, extending the limits of his favourite science, engrossed his interest and attention for a brief period; but such was the sole comfort he ever afterwards knew, and it too was rare and short-lived. The only work which he seems to have undertaken subsequent to this period is a memoir on the analysis of vegetable and animal principles, a field of investigation in which he had already distinguished himself, and in which, once more, with his usual profound penetration, he anticipated and led the way to the recent discoveries of Gay-Lussac and Thenard, who reduced these complicated combinations to their elements by means of combustion.

It was in this heart-broken manner that the remaining years of Berthollet were spent. It is indeed an awful lesson to the frailty of human nature to see a happiness the purest that man can ever enjoy, cut at once to the heart's core, to witness the near prospect of the tranquil close of so long a life, which in every vicissitude had been adorned by honour and integrity, and in many a period gloriously illuminated by fame, in one awful moment broken up and clouded for ever. From the day that his son died, no smile ever passed over his features; his air, once so sprightly and cheerful, remained sombre and gloomy; and often the unbidden tear forced itself down his aged cheek. Death seemed no longer an evil, as life seemed to separate him from his child. And in a few years that stern but sure comforter reached the melancholy Berthollet.

His end was worthy of the manner in which he had lived. A fever, apparently slight, left behind it a number of boils, which were soon followed by a gangrenous ulcer of uncommon size. Under these he suffered for several months with the greatest constancy and fortitude. His complaint was of that desperate nature which medicine cannot cure. He himself, as a physician, knew the extent of his danger, felt the inevitable progress of the malady, and steadfastly but calmly regarded the slow advance of death. During all this time, his mental suffering, and the loss of his son, engrossed him more than his bodily pain. At length, after a tedious period of suffering, in which his equanimity had never once been shaken, Berthollet died on the 6th of November, 1822, at the advanced age of 74 years. He has left the faithful partner of his joys and griefs to mourn his loss in desolate, childless widowhood.

The robust constitution of Berthollet had led his friends at one time to anticipate for him a much longer life. But the weight of grief which latterly oppressed him gave a fearful strength to the disease that invaded him, and these together seemed to cut him off ere his full time had yet arrived. Since the death of his friend Monge, and the illustrious La Grange, the sciences in France have not sustained so severe a loss. One of the founders, and always one of the best supporters and elucidators of modern chemistry, save only the gloom of his latter years, no man ever ran a longer or more brilliant career of fame.

Berthollet was, in fine, one of the most open-hearted, one of the most sincere, and kind of human beings. How beautiful a trait of simplicity of character is the first step that he makes into the great world—the first acquaintance that he forms in Paris—his unprepared approach to Tronchin, whose disinterested kindness seems to have been worthy of the open confidence reposed in him by the young physician, and who had thereby the

honour to contribute most materially to the subsequent success of his protegé. Nor did any man possess more mild and unassuming manners than Berthollet, who, on one occasion, after a previous keen controversy, had rendered a certain philosopher almost afraid to meet him, nevertheless gave that very man so unreserved and so kindly a reception when they next encountered, as to force the tears of surprise and gratitude from his eyes.

No man ever had more friends, or preserved more sincere and lasting intimacies than Berthollet. He won men by his openness and candour, and he retained them by his affection and kindness. After all the honours to which he had been advanced, his deportment remained as simple and as unaffected as ever. He was never a courtier; and had the singular merit of being alike firm in his integrity under the reign of terror, and under both the reproaches and the favour of Napoleon. Alas! it is painful to think that a man every way fitted to adorn and exalt human nature, after so noble and honourable a course of life spent amid every danger and vicissitude, should have his latter days clouded by a fate so severe, yet over which he had no control. But the sun shines, and the rain descends, alike upon the evil and upon the good. The sufferings are now gone,—the sorrows are now passed away,—but immortal among all who love science, country, or mankind, will be the hallowed memory of Claude-Louis Berthollet!

CULTIVATION OF WATER CRESS.

In 1808, a Mr. Bradberry began to cultivate, for the first time, we believe, water-cress for the London market. He found it answer so well that he has since continued it, and now sends a supply to the metropolis regularly every day throughout the year, except Mondays. He conceives there are three sorts of this vegetable, the *green leaved*, the *small brown-leaved*, and the *large brown-leaved*. They have all the same taste, but the large brown-leaved is preferred in the market. These three species may be seen growing together, though in particular waters some thrive better than the others. The green-leaved is the easiest of culture; the small brown-leaved is the hardiest; but the large brown-leaved is the only one he cultivates, on account of its being the only one that can be grown in situations where shallow water cannot be obtained. He first procured young plants, and placed them with a small proportion of the wet earth in which they grew in shallow running water, the plants soon formed large tufts, and rapidly spread over the water. It was soon found that the plants grow better, and are more easily cultivated and cut, when planted in rows parallel to the stream. When the water is deep, the rows are five, six, and seven feet apart; but when it is shallow, eighteen inches space betwixt them is sufficient. When the water is about one inch and a half deep the plants are found to thrive best. As the plants grow they check the current and deepen the stream. In deep water the roots are easily torn out of the ground, which makes gathering the leaves difficult. The shoots are cut, not broken off, which is found to injure the plants, and after repeated cuttings the heads grow small. The mud collects quickly about the roots, and duckweed and other roots choke up the cress. This makes it necessary to clear out the beds, and replant them twice a year. The mode of replanting is to remove all the rows of plants, beginning at the stream head, and clearing the bed of the stream from mud and rubbish, which however are good manure. The youngest plants and those with the most roots are then selected, and are placed on the gravel in rows, at proper distances, and a stone is placed on each plant to keep it in its place. The cress does not grow freely in a

muddy bottom, nor with mud about its roots, which must be replaced by chalk or gravel. A constant current also is necessary; without that the plants do not flourish. The beds are renewed in May, June, September, and November, and in succession, so that the plants may be fit for cutting at different periods. Those planted in May may be cut in August, and those planted in November may be cut in the spring. After being cut three times the plants begin to stock, and then the oftener they are cut the better. Each bed supplies in summer a gathering once a week, and then it is necessary to keep them closely cut. In winter the water should be rather deeper than in summer, which is effected by allowing the plants to grow thicker, they thus stopping the stream. Mr. Bradberry has as much as five acres planted with cress. The water in his plantations comes from the springs which rise in the swampy meadows bordering on the river Colne, his plantation not being far distant from the source. The plants thrive best in newly risen spring water; and as this rarely freezes, they are fit for gathering all the year round. The large space under cultivation at West Hyde, where Mr. Bradberry's plantations are at present, has been gained by widening the beds of the small streams, which are made of an uniform depth, and the whole bottom is covered with gravel. This cultivation has ensured a constant and regular supply of water-cress to the metropolis.—*Trans. Hort. Society*.

MR. DICKINSON'S MODE OF CLEARING BEER.

(*In answer to a Correspondent.*)

THE barrels are placed upright, and are filled with wort previously boiled, and mixed with the proper quantity of yeast, to promote fermentation. On the top of every barrel is placed a little tub, having a pewter pipe six or eight inches long passing through it, and perfectly tight at its junction with the tub. The lower end of this tube enters the barrel, and is packed tight, so that no yeast can escape but by rising up through the tube, when it flows into the tub. The tub is filled with as much wort without any yeast as will be required to fill up the space made by the rejection of the yeast, as the fermentation in the barrel goes on. This fresh wort flows from the tub into the barrel through a small hole in the pewter pipe a little above the bottom, while the yeast from the barrel, as the fermentation goes on, flows up through the tube. The use of this contrivance is to discharge the yeast from the beer without any waste whatever, and keep the barrel constantly full of beer without the constant attention of the brewer. Here is a quantity of beer saved, Mr. Dickinson says one and a half per cent; and besides the saving of labour already pointed out, the beer is or may be fermented in the casks in which it is to remain. No fermenting tun is necessary, but a number of tubs with pewter pipes are required. We see no chemical principles whatever involved in this plan: it is a neat mechanical contrivance, which saves labour and, consequently, expense.

COLD PRODUCED BY DILATATION.

A VERY curious phenomenon is produced during the action of the fountain of Hiero, at Schemnitz, in Hungary. The air in the machine is compressed by a column of water 260 feet high, and when a stop-cock is opened, so as to suffer the air to escape, its sudden rarefaction produces a degree of cold, which not only precipitates aqueous vapour but causes it to congeal in a shower of snow, and the pipe from which the air issues becomes covered with icicles.—*Davy's Elements*.

VEGETABLE WINDOW ORNAMENTS.

To the Editor of The Chemist.

Mr. Editor,—In the New Monthly Magazine for February, I noticed a little paragraph, under the head of 'Rural Economy,' [this we have inserted] which reminded me of a practice I have often seen in Germany, and which appears to me superior to the one mentioned in the above publication, it being both prettier and more easily executed.

Perhaps a short description of this may please your readers, if you condescend to give it a place in your little publication.

Take, about the middle of the month of November, a dozen very large carrots, or, what is still better, turnips; cut off the root end, and hollow the bulb or stem so as not to injure the germs, leaving the substance about an inch thick all round. Take some strong tape, red if you please, and suspend the carrot or turnip, the hollow part upwards, from a rod across the window, or from any other convenient place; what is naturally the top part of the vegetable is thus undermost. Fill the hole with water, which you must take care to renew every morning; and if you choose, put into it a hyacinth root. This will begin to grow and blossom, as well as in a flower-pot filled with earth. The carrot or turnip sprouts out at the same time, and turns it leaves upwards, so as almost to hide the root itself. With its yellow blossoms and the tender green of the leaves, it forms a very pretty ornament. Take care, however, to renew the water often enough, or it will else give an unpleasant smell.

I am, Sir,

Your obedient servant,

E.

LUTING FOR IRON PIPES.

The Roman cement, or Parker and Wyatt's cement, applied to the joints of cast iron pipes, hardens on them like stone, and effectually prevents the escape of fluids.

POWER OF THE STEAM-ENGINE.

(Illustrations.)

Aladdin's fabled lamp, which enabled its bearer to explore the hidden treasures of the earth, to wander unhurt amid malignant demons, and to return to the surface laden with spoil, is more than realized by Sir H. Davy's wondrous invention. The winged horse is but a feeble representative of the aerostatic machine, by whose buoyancy man may rise to elevations above the eagle's flight; and the enchanted boat, which glided against the current and the breeze, is far surpassed by our actual steam-ship, the modern leviathan, which instinct with fire, marches over the mountain wave, and bids defiance to the storm.

It is ascertained, that the work now performed by the steam-engine of Watt in Great Britain, is equivalent to the labour of about half a million of stout horses; but the horses require relays in order to continue the work, and therefore at least *double* the number would be required in the course of 12 hours, forming the amazing aggregate of one million, equal to the labour of five millions of men.

The volume or bulk of the great pyramid of Egypt is equal to nearly 5,333,333 cubic yards, and the weight of one cubic yard of its material being about two tons, its whole weight is 10,666,666 tons. The centre of gravity of the pyramid stands 54 yards above its base, and taking 12 yards as the average depth of the quarries from which the stones were raised, we have for the total altitude of that centre 66 yards, which multiplied by 10,666,666, give about 704 millions of tons, elevated one yard high.

Now the British steam-engines represent a power of 500,000 horses; these machines moving for 24 hours, can raise 3420 millions of tons one yard high, taking Watt's estimate of 32,000 lbs. one foot high in a minute for a single horse power, consequently they could raise 704 millions of tons, being the

equivalent weight of the pyramid, in less than five hours.

M. Dupin, three years ago, astonished the Institute of France, by showing that the British engines could raise all the stones of the pyramid from the quarries into their respective places by 18 hours' work, but he must have greatly underrated the power of the steam-engine, even allowing for their rapid increase since that time. Herodotus tells us, that the great pyramid employed in its building the whole available population of Egypt for 20 years; Cheops, the king, was so detested for imposing this grinding labour on his subjects, which totally impoverished the country, that they suffered neither his own bones nor those of his posterity to repose in this absurd mausoleum. Now mark the difference between ancient and modern industry—between that of slaves and of freemen. All the labour of Watt's engines is employed in productive operations, nourishing the people, and enriching the state to a degree which it is not easy to imagine or compute.—*Dr. Ure's Lecture on the Steam-engine.*

AVANTURINE.

This is a species of precious stone, which is very handsome. It is a variety of quartz. It may be successfully imitated, and is so frequently, by the following method: — Snuff-boxes, and other things of the same kind, are made either of wood or of pasteboard, and then coloured like avanturine. A varnish, which is very useful for every sort of gilt and silver work, is first prepared as follows: pure alcohol, by weight, 15 parts, Venice turpentine 3 parts, sandaric gum 3 parts, are to be put into a bottle well corked, and submitted to the action of a boiling water-bath for three hours, by which the turpentine and the gum are completely dissolved. Powdered glass, equal in quantity to the gum and turpentine, is sometimes added, which promotes the mixture. The varnish is afterwards filtered, and then put into a bottle with a narrow mouth, that is kept closely corked till wanted. To make the *avanturine*, the pasteboard or thin wood is covered with two coats of this varnish and two layers of *gumma gutta*, dissolved in varnish. It is dried, and afterwards varnished in places, and over these places gold powder is strewed; other places are then varnished, and the powder put on them till the whole is covered. If too large a space is varnished at once, it is apt to dry, and the powder is not equally distributed. When enough gold has been distributed, the whole is varnished over about sixteen times, and then dried and polished. It is finally varnished again six times, and polished with putty.—*Dictionnaire Technologique.*

BOILING POINT OF LIQUIDS.

Dr. Bostock has announced, in a letter to the Editor of the Annals of Philosophy, that he has observed the boiling point of liquids, particularly of ether and alcohol, is altered very considerably by the addition of any small extraneous substances, such as small chips of wood, &c. In the case of ether, the difference amounted to more than fifty thermometric degrees. We shall give these experiments in our next.

TO DETECT COPPER WHEN MIXED WITH GOLD.

Pure gold is nearly twice as heavy as copper, and thus, when alloyed with this latter, may be detected by the specific gravity. To make quite sure, take the suspected alloy, and touch it with the point of a glass rod just dipped in nitric acid; if the part touched with the acid become blue or green, it contains copper, but if it remain unaltered by the acid, it is pure gold.

QUERIES.

To the Editor of The Chemist.

SIR,—I should be very much obliged to any of your numerous Correspondents, if they would inform me the best composition for flint glass, the batch to be 12cwt.; one in the regular practice of mixing would be the likeliest.

How to make a small gas apparatus for my own use, to supply three small lights, from dusk till ten each evening, at least expense.

The best method of constructing a small furnace to try experiments on glass, say about a pound or two at greatest.

I am, yours, &c.
A constant reader,
G. T.

How may the alloy in standard silver be destroyed on the surface, and the silver left of a perfectly dead white, such as the French are celebrated for producing?

ANSWERS TO QUERIES.

To the Editor of The Chemist.

SIR,—I beg leave to submit for insertion the following Answers to Queries.

I remain,
Your obedient servant
and well wisher,
T. P. jun.

Lycopodium.

This article, which is used at theatres, &c. to imitate lightning, if I am not mistaken, is the seed or fine dust of the lycopodium or clubmoss, and may be purchased at some of the great physical herb shops. I have tried to get some myself, but have never succeeded. When diffused or strewed in the air, it takes fire from a candle, and burns off like a flash of lightning.

A Preparation to clean Paintings.

Take two ounces of muriatic acid, three-quarters of an ounce of litharge, (protoxide of lead,) mix them well together, and let them stand twenty minutes, the preparation is then fit for use. To use it, take a sponge, dip it in the liquid, and rub it over the painting well; continue the rubbing a quarter of an hour, and then wash it off with soap and water.

N. B. This is only for oil paintings.*

Essential Salt of Lemons.

This is the oxalate of potassa, which is made by saturating the base with the acid, and evaporating and crystallizing.† T. P.

* Our inquiring Correspondent is also referred to No. 43, page 238, of The Chemist.

† The essential salt of lemons is oxalate of potassa, but not the neutral salt; the base is, as our Correspondent states, saturated with acid. It is generally obtained, we believe, from the leaves of either *wood* or *common sorrel.*

TO CORRESPONDENTS.

"P. S.," York, is mistaken in supposing that every new and valuable discovery, connected with our subject, does not find its way into The Chemist. He is evidently not acquainted with the scientific works which are continually appearing, or he would not suppose them to be mines of new and important information. Whatever appears of the least value, either in foreign or native journals, is immediately transferred to the pages of The Chemist. The first part of his letter shall be attended to.

"A Young Chemist" has, probably, poured too much sulphuric ether on the water, and the heat might then be transmitted by the glass. We do not know to what his postscript refers, and shall be glad to hear more exactly.

"J. D. S." had better procure the muriate of lime from some working chemist, as it is usually obtained by the decomposition of muriate of ammonia, and may thus be got cheaper than he can probably make it. If he desires to make it, however, he must add muriatic acid to dry carbonate of lime or chalk; and when the effervescence has ceased he may add the water.

⁂ Communications (post paid) to be addressed to the Editor at the Publishers'.

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The Chemist.

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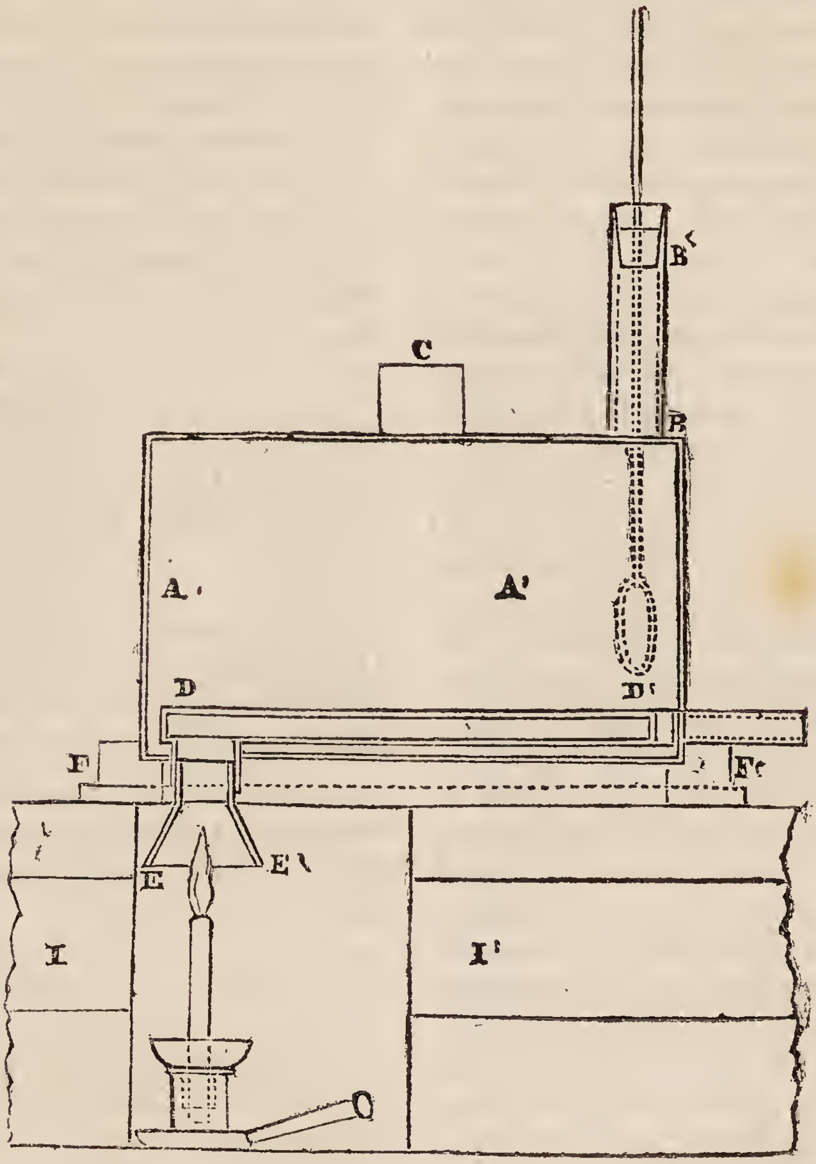

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COUNT RUMFORD'S WATER CALORIMETER.

THIS instrument, which has lately been much used in France, particularly by Messrs. Delaroche and Berard, and Mr. Clement, in their experiments for determining the specific caloric of bodies, consists in a copper or tin box, A A, about 8 inches long, 5 broad, and 6 high. This box or case contains a worm, D D, through which the products

of combustion pass. It is made of the same materials as the case, of a square form, and about an inch and a quarter in dimensions, and about half an inch thick. It passes three times backwards and forwards through the box, about 1-8th of an inch from the bottom. At one extremity it is terminated by the reversed funnel, E E, which receives the flame of the substance burned. The other extremity passes out of the box horizontally, at the end opposite where the worm commences. A thermometer placed in the opening B B, points out the temperature of the water at every instant. To make use of this instrument, the box A A has a known and determinate quantity of water poured in it by the opening C. I I shows the frame on which the instrument rests. The substance to be experimented on, suppose it to be wax, is made into a candle with a very fine wick; it is then weighed, placed under the funnel, and lighted. At the commencement of the experiment the water should be about 10° below the temperature of the air. The flame enters the worm, and is supposed to communicate nearly all its heat to the water. When this is raised to a temperature as much above that of the air as it was below it at the commencement of the experiment, the flame is extinguished. What remains of the substance is again weighed, and thus the quantity burned is accurately known. A portion of the heat is lost by radiation: this may be allowed for; and after this allowance is made, and the temperature the water was raised to has been noticed, the quantity of heat disengaged during the combustion may be known. As the thermometric quantity of heat necessary to convert a given quantity of ice into water is known, the results obtained by this instrument may be easily compared with those obtained by a calorimeter of ice, such as we have already described.* Messrs. Delaroche and Berard, in their experiments on gases, used the water at the commencement about 4° above the temperature of the air. They then raised it gradually by sending slowly and equably through the funnel a given volume of the gas at the temperature of 212°, of which the specific caloric was to be ascertained. The gas was kept at this temperature by being made to pass within steam, under a given and known pressure. These eminent chemists obtained, by this way, the following results, and on their labours Dr. Ure has bestowed very great praise. The specific caloric of the under-mentioned gases, air being unity, was as—

	Equal Volumes.	Equal Weights.
Air . .	1·0000	1·0000
Hydrogen	0·9033	12·3401
Carbonic acid	1·2583	0·8280
Oxygen .	0·9765	0·8848
Azote .	1·0000	1·0318
Oxide of azote	1·3503	0·8878
Olefiant gas	1·5530	1·5763
Carbonic oxide	1·0340	1·0805
Aqueous vapour	1·9600	3·1360

Taking water as the standard to compare these results with others, the relation was found to be as follows:—

	Equal Weights.
Water . .	1·0000
Air . .	0·2669
Hydrogen .	3·2936
Carbonic acid	0·2210
Oxygen .	0·2361
Azote . .	0·2754
Oxide of azote .	0·2369
Olefiant gas .	0·4207
Carbonic oxide .	0·2884
Aqueous vapour	0·8470

TO RECTIFY SPIRITS.

Fill a bladder about half full of spirits of wine, whiskey, or other ardent spirits, and close the orifice, then expose the bladder to the sun, or the heat of a stove, and in a short time the spirits will be highly rectified. In this way may all the water be evaporated, without losing any of the spirits; for the bladder is, in fact, a filter which allows the passage of the water but retains the alcohol.

* Chemist, vol. i. p. 249.

ON THE BOILING POINT OF SOME LIQUIDS.

(*By Dr. Bostock.*)

During the months of December and January, I was making some experiments on the action of ether and water upon each other, and particularly with regard to the effect produced upon ether by washing it. Among other circumstances, I wished to ascertain the exact boiling point of ether before and after the operation of washing, and to compare this with the diminution of specific gravity which it experiences by this process. By heating ether of the specific gravity of ·755 in a matrass which contained a thermometer, over a spirit-lamp, I found that ascending and descending currents began to be visible in the fluid at 107°; at 110° a few small single bubbles were formed, and that at 112° the ebullition was complete. It seemed, however, difficult to ascertain the object in view by this process, as a difference of 2° generally exists between the first formation of a single bubble and the production of what may be called complete ebullition. Besides, it was often difficult to observe the exact height of a delicate thermometer, on account of the sudden bursts of vapour which arose from the fluid, and it occasionally happened that after ebullition had appeared to be going on at a certain temperature, it would cease, and not recommence until the thermometer had risen, perhaps, more than a degree. It appeared, however, that ether of the specific gravity of ·755 could not be raised above the 112th degree, and that at this point it was always in a state of complete ebullition.

In order to obviate these difficulties, I poured a quantity of ether into a wide test tube, and plunged the tube into a large jar of tepid water, the temperature of which was gradually raised by adding portions of hot water, beginning at 110°, and was much surprised to find that it was not until the water had arrived at the 150th degree that the ether began to boil. Suspecting some peculiarity in the tube, I employed a second and a third, with the same result; but upon trying a fourth, I observed a minute stream of bubbles rising up from one point of the glass, and on examining the part, I perceived a small fragment of some substance adhering to it. This occurrence led me to try the effect of introducing an extraneous body into the ether, and I accordingly droped into it some small chips of a cedar pencil, which happened to lie on the table, when the wood was instantly covered with bubbles, and the fluid was quickly brought into a state of rapid ebullition, the bubbles appearing to arise, at least in a great measure, from the surface of the wood. Precisely the same effect was produced by portions of quill or filaments of feather.

I now reversed the experiment, and continued to add portions of cold water to the jar, in order to observe at what temperature the ether would cease to boil, when I found that the same ether, which scarcely boiled in a clean tube at 150°, by adding the pieces of cedar, exhibited a perceptible, although slight ebullition, when the water was at 102°. When the wood was first introduced, it was suspended in the upper part of the fluid, and was covered with a stratum of fine bubbles; by degrees, however, it appeared to be completely soaked in the fluid, gradually sunk to the bottom, and the ebullition nearly ceased; but by the introduction of a fresh piece, it was reproduced, and might in this way be continued at pleasure. Other substances were afterwards dropped into the ether; small fragments of broken glass lowered the boiling point very considerably, but not to an equal degree. When a small bit of metallic wire was dropped into ether at 145°, a sudden and copious explosion of gas or vapour was produced, and the ebullition afterwards continued at a much lower temperature, but the effect was so rapid and violent, that I could not

mark the exact number of degrees of the depression; very nearly the same effect was produced by dropping copper filings into the ether, or immersing a thermometer. When the ether in the clean tube was plunged into the hot water, it assumed a waved or streaked appearance from rapid currents which were moving up and down it in various directions; and the process of evaporation went on so rapidly, that a very sensible degree of cold was experienced by the finger when held over the mouth of the tube.

Although in most cases the ether in the clean tube began to boil at about 150°, in some cases the water in the jar has been raised to a higher temperature without producing ebullition, in one instance as high as 175°, with the formation of only one or two single bubbles. In this case a fragment of glass produced a copious ebullition, which continued until the fluid was cooled to 125°, when the effect was again reduced to the discharge of a few single bubbles; a cedar chip was then introduced, and produced a rapid ebullition. In one experiment, the three bodies, copper filings, fragments of glass, and chips of wood, were added in succession to the same portion of ether, and they each of them appeared to have the effect of producing ebullition when it had ceased from the action of the body previously employed. Plunging a thermometer into the ether caused the production of the bubbles at a temperature many degrees below the point at which ebullition took place without the thermometer, but the effect of the thermometer was, after a short time, no longer perceptible, and I observed that by alternately plunging the thermometer into the ether, and removing it from the fluid, the bubbles were produced at each immersion.

It appeared that in order to produce the full effect with the pieces of cedar wood, it was necessary that they should be perfectly dry; and I also found that wood which had been once employed, although perfectly dry, was not so powerful as fresh pieces: in one case, by adding fresh bits of wood successively to a portion of ether, the boiling point was lowered from 150° to 96°.

The effect of the pieces of cedar appeared more remarkable by plunging into the same jar of water two tubes of ether, one without any addition, the other with the chips; in one experiment when the ether alone scarcely boiled at 165°, emitting only occasional single bubbles, the tube containing a piece of cedar was in violent ebullition; the temperature was gradually lowered; and even at 102°, the formation of a continued stream of small bubbles was very perceptible.

In order to observe whether any thing of a similar kind could be perceived with respect to alcohol, a portion of alcohol of specific gravity ·848 was heated in a matrass over a spirit-lamp; a thermometer being immersed in the fluid stood at 182°; the lamp was removed, and the ebullition ceased; but upon dropping into the alcohol a cedar chip, a fine stream of bubbles was observed to issue from it; the temperature of the fluid was now 14° below its former boiling point. Into another portion of alcohol which appeared to be near the boiling point, as was indicated by the appearance of rapid currents and by a slight hissing noise, a few copper filings were dropped; the ebullition was considerably promoted, and proceeded, as it were, by sudden starts, the bubbles always proceeding from the filings. In a later experiment, the boiling point of the alcohol was reduced as much as 30° and 40°, by dropping in successive pieces of the cedar wood.

I was desirous of ascertaining whether any analogous effect would be produced upon water, and for this purpose a small portion of well boiled distilled water was plunged into a flask of water that was in a state of rapid ebullition. The water in the tube was not perceptibly affected; the lamp

which had been employed to boil the water being removed, the ebullition instantly ceased: some fragments of cedar were then dropped in, and perceptible streams and bubbles were, for some time, emitted from them. In a second experiment, copper filings were employed; a number of bubbles instantly attached themselves to the filings, and quickly rose to the surface, frequently carrying up the metal along with them. I will not, however, venture to determine how far, in the case of the water, the effect might depend upon a quantity of air still dissolved in it, or upon air which adhered to the surface of the bodies introduced, although from the quantity of effect, and the length of time during which it continued, I should scarcely think it ought to be altogether ascribed to this source.

A saturated solution of muriate of soda afterwards was heated over a lamp; at 210° it was in a state of strong agitation, and simmered loudly; at 214° single bubbles were discharged; at 218° or 219° it might be said to be in the boiling state, but the thermometer continued to rise until 222°, when the fluid was in strong ebullition. A test tube, containing water deprived of air by boiling, was plunged into the heated brine, and in a second or two it began to boil. The lamp was then withdrawn, when the brine soon ceased to boil, but the ebullition continued in the water for some time longer; it ceased at about 218° or 217°, but was instantly renewed by dropping in pieces of cedar wood. The brine was again placed on the lamp, and a test tube was plunged into it, containing a portion of water, together with a thermometer. The water in the tube did not begin to boil until the thermometer had risen to between 216° and 217°, when ebullition first commenced; the fragments of wood were then dropped in, and, as usual, very much increased the ebullition. The fluid was kept for some time at this temperature, and the extraneous bodies were alternately added to the water, and removed from it, when the ebullition was promoted or suspended accordingly for several times in succession. It would appear, therefore, that the boiling point of fluids, while under the same atmospherical pressure, is less uniform than has generally been supposed, and that it is materially influenced by the presence of extraneous bodies. In ether, this difference amounts occasionally to 50° or more, and in water to 4° or 5°.

DICTIONARY OF CHEMISTRY.

Hæmatites, *ore of iron.*

Hair consists principally of a substance having the properties of coagulated albumen. It also contains gelatine; and the soft kinds of hair yield this more readily than the harsh strong kinds.—Vauquelin says that there are two kinds of oil in hair, one white, and existing in all hair; the other of different colours, according to the hair. In hair traces also were found of iron, oxide of manganese, phosphate of lime, carbonate of lime, and silica. Vauquelin supposes that when hair has become suddenly grey, it is caused by some acid secretion destroying the colour of the oil.

Harmotome, *cross-stone.*

Hartshorn, Spirit of, Salt of. *Liquid ammonia.*

Hatchetine, *mineral adipocere.* A fatty matter, found in the argillaceous iron ore at Merthyr.

Hauyne. A species of *azure stone*, of a blue colour. It consists of silica, alumina, lime, sulphuric acid, potassa, and iron, the proportions of which are differently stated by different persons.

Heart Wood. The inner or dead part of the tree.

Heat, *caloric, matter of heat.* The first term has two significations, which must always be remembered, to think correctly. It signifies the sensation of heat, and also the cause of that sensation. About the former there can be no mistake; but the latter meaning has given rise to a great number

of theories, some of which, if not all, must be erroneous.

Heavy Spar, *baryte*, *sulphate of baryta*. A mineral genus, of which there are four species, the rhomboidal, prismatic, diprismatic, and axifrangible. Properly speaking, the prismatic is *heavy spar*, or sulphate of baryta; the others being carbonate of baryta, or of strontian.

Heliotrope. A sub-species of *rhomboidal quartz*. It consists of silica 84, alumina 7.5, iron 5. Seals and snuff-boxes are made of it.

Heliotropium, *turnsole*, *litmus*. The tincture used in chemistry as a test was formerly called *heliotropium*.

Hellebore. A poisonous root, formerly much used in medicine. The only antidote is vomiting.

Helvine. A sub-species of garnet, found in Saxony.

Hematin. The colouring principle of logwood.

Henbane, *hyoscyamus niger*. The leaves of this plant contain a highly poisonous salifiable base, or vegetable alkali, which Dr. Brandes has called *hyoscyama*.

Hepars, *hepar sulphuris*. Alkaline and earthy sulphurets, so called from their liver colour.

Hepatic Air, *sulphuretted hydrogen gas*.

Hepatite. A species of *heavy spar*, having a fetid odour when rubbed.

Hessian Crucibles. A particular species of crucible, made of alumina and sand.

Highgate Resin, *fossil copal*.

Hollow Spar, *chiastolite*.

Holmite. A mineral, consisting of 27 lime, 21 carbonic acid, $6\frac{1}{2}$ alumina, $6\frac{1}{2}$ silica, 29 oxide of iron, 10 water.

Homberg's Phosphorus, *ignited muriate of lime*, or *chloride of calcium*.

——— Pyrophorus. When alum is ignited with charcoal, the compound is found to be spontaneously inflammable, and is then called *Homberg's pyrophorus*, from its discoverer.

——— Sedative Salt, *boracic acid*.

Hone, *whet-stones*. The *whet-slate* of mineralogists.

Honey is supposed to consist of sugar, mucilage, and an acid. It may be separated into crystallizable and uncrystallizable portions, by mixing it with alcohol and pressing it in a linen bag. The liquid sugar passes through, the granular mass which remains forms crystals, when its solution in boiling alcohol is allowed to cool.

ANSWER TO QUERY.

GAS APPARATUS.

In answer to inquiries in the last Number of The Chemist, respecting a gas apparatus, much must depend on local circumstances; for instance, if you are in the habit of keeping a good fire in the kitchen, it may be advantageously used for the purpose of the decomposition of oil or coal; and if only a small quantity of gas is wanted, the former is most adapted for the purpose, as the process requires scarcely any attendance, and may at any time be stopped by the turn of a small cock. The apparatus described in No. 40 * of the Mechanics' Magazine may be used with advantage, only in that case the back should be set in such a manner that the heat may pass behind as well as before (as it should have been observed in that description). The retort should be kept red hot, if not the fluid will rise in steam instead of undergoing decomposition; but in some cases a tube may be substituted with advantage; in that case it should be near the back of the fire-place. If the fire-place back against a side wall, coal gas may be made, and the retort be charged through an aperture from the outside. Block tin or pewter tubes should be used to conduct the gas from the gasometer. If a steady light is wanted use argand burners; if merely a good light, the bat wing combines economy with cheapness. S. T.

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* The little article alluded to in the letter of our Correspondent shall appear in our next Number.

PLATING WOOD.

The Parisians have introduced an entirely new mode of polishing, which is called plaquey, and is to wood precisely what plating is to metal. Water may be spilled on it without staining, and it will resist scratching in the same degree with marble. The receipt for making it is as follows:—

To one pint of spirits of wine add half an ounce of gum shellac, half an ounce of gum lac, half an ounce of gum sandaric; placing it over a gentle heat, frequently agitating it until the gums are dissolved, when it is fit for use. Make a roller of list, put a little of the polish upon it, and cover that with a soft linen rag, which must be slightly touched with cold-drawn linseed oil. Rub them on the wood in a circular direction, not covering too large a spaee at a time, till its pores are sufficiently filled up. After this rub in the same manner spirits of wine, with a small portion of the polish added to it, and a most brilliant effect will be produced. If the surface has been previously polished with wax, it will be necessary to elean it off with glass paper.

STEAM-ENGINE WITHOUT BOILER.

The *Newport* (United States) *Mercury* states, that an experiment has just been made in erossing Bristol Ferry with a steam-engine without a boiler, invented by Mr. John Badcock. The experiment was completely successful. The following is the description of the engine:—

"The substitute for a boiler of a ten-horse power engine consists of two sections of cast iron tubes, one inch thick, each 16 feet in length, in lengths of three feet and a half, and averaging an inch and three-quarters bore, and containing about three gallons, placed horizontally in a small furnace, three and a half by four and a half feet, and three feet high. The end of one tube enters into the top of a cylinder six inches and a quarter in diameter; the end of the other enters into the bottom; the other ends go out on opposite sides of the furnace, and to each is attached a small forcing-pump, one inch in diameter, and they are alternately worked by gearing attached to the cross head. The cylinder is also enclosed in the furnace, and the length of the stroke of the piston is two feet two inches. The motion is communicated by shaekle bars in the usual way, and there is no variation from the common construetion of a high-pressure engine. To set it in motion, a fire is made in the furnace with a few sticks of small wood, or half a bushel of coal, and when the tubes are heated, only three eubic inches of water are injected from the forcing-pump upon the hot iron, and it is instantly converted into steam; a valve at the same time being opened into the cylinder, it forces down the piston; the other pump then forces the same quantity into the tube; another valve is opened, and the piston ascends; and it continues to operate with unabated vigour as long as it is supplied with water. The number of strokes made by the piston in a minute is about 40, while propelling the boat; and the quantity of water then used is only a gallon in four minutes. It is neeessary that it should be fresh water, as the tubes are so small that they get clogged by either salt or sediment; but this is no objeetion, as by adding a condenser, nearly the whole can be retained, and we believe it will be found to combine the four requisites, cheapness, simplicity, strength, and utility, of a perfect machine. The whole space occupied by it does not exceed that of a small tea-table; and the power may be indefinitely increased without much enlarging the size, and with few alterations it ean be easily adapted to any engine now in use."

Fig. 1.

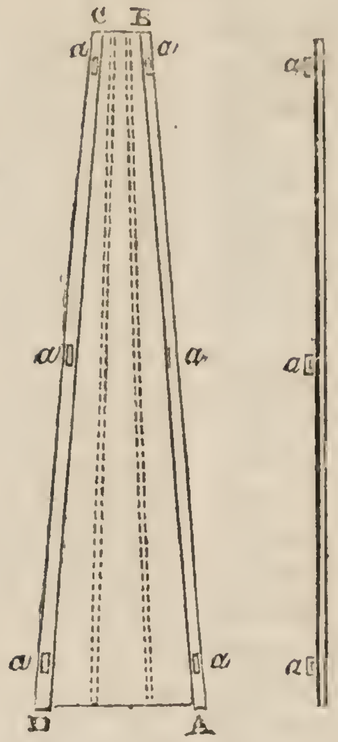


Fig. 2.

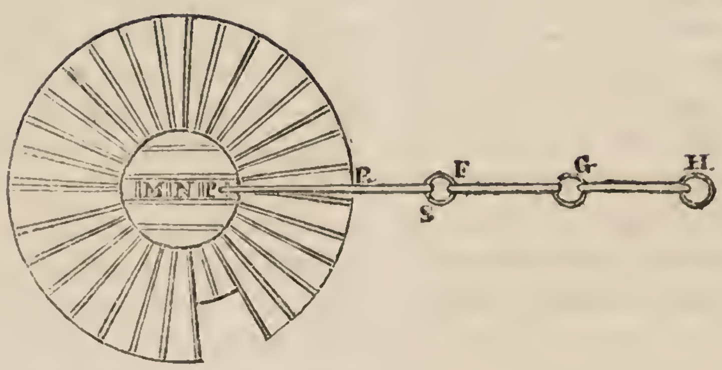
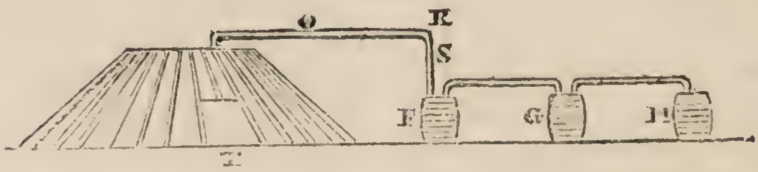


Fig. 3.



CURIOUS MODE OF BURNING CHARCOAL.

In France it is now very much the practice to obtain pyrolignous acid from the wood which is converted into charcoal in the forests. There is hardly charcoal enough burnt in England to make the process of much importance here; but it may still be interesting to some readers. To carry on this process stone or brick buildings were formerly erected, which not being easily moved, they soon exhausted the supply of wood in their neighbourhood. To remedy this, a M. Foucauld constructed a moving shelter, as it is called, in the following manner:—It is 30 feet diameter at its base, and 10 at its summit. He made a frame of wood two inches in substance, 12 feet long, there feet wide at one end, and one foot at the other: it is represented in fig. 1. The exterior pieces, A B and C D, are fitted with small holes, *a a a a*, by which they can be united with other similar frames. They are united by means of pieces of wood passed through these holes, and the joinings are made tight by means

of earth mingled with herbs formed into a paste. A cover is formed of planks, and is provided with trap-doors, M N P, the former being destined to allow of the passage of the first smoke. Through P a tube passes, Q R S, fig. 3, formed of planks, destined to carry off the gas, and the liquids which are condensed in casks represented by F G H. T is a door which opens and shuts at pleasure, and permits the charcoal-burner to visit his fire at pleasure. By employing a covering of this description, the wood is converted into charcoal beneath it; and by covering the interior of the shelter with chalk, the acid which escapes during the combustion forms with it an impure acetate of lime. When the whole wood where the shelter has once been fixed is consumed, it is easily removed, and the manufactory of charcoal and of acid is begun at another place.

TO PRESERVE FRUITS AND FLOWERS.

Mix one pound of nitre with two pounds of bole ammoniac and three pounds of clean common sand; then, in dry weather, take fruit of any sort, which is not fully ripe, allowing the stalks to remain, and put them one by one into an open glass till it is quite full; cover the glass with oiled cloth closely tied down. Put the glass three or four inches down in the earth, in a dry cellar, and surround it on all sides to the depth of three or four inches with the above mixture. The fruit will thus be preserved quite fresh all the year round.

QUANTITY OF RAIN.

To the Editor of The Chemist.

Sir,—I was not aware of the curious meteorological fact mentioned in one of your late Numbers, as to the difference in quantity of rain which falls on a given space at different heights. Will you or any of your ingenious correspondents do me the favour to state what objection can be made to the following explanation?

The aqueous particles, whilst suspended in the atmosphere, exist in the state of vapour, and are precipitated in consequence of the greater specific gravity acquired by their condensation to a state of liquidity. This change from the vaporous to the liquid form is in fact nothing more than a closer approximation, or nearer contact of the particles, and, by whatever cause occasioned, necessarily proves an attractive influence exerted by the particles themselves towards each other. If, then, it be true, as we are told by the most eminent philosophers, that this force, the attraction of cohesion or aggregation, may be regarded as acting at sensible and insensible distances, it necessarily follows that at a greater elevation the drops of water are at a greater distance from each other than at a less, and consequently a less quantity would fall on a given space. Should you think this worthy of notice, it may perhaps induce some of your scientific readers to exercise their ingenuity on such an interesting phenomenon.

Your friend,
Observator.

CLEARING BEER.

A Correspondent suggests that the bung-hole in the head of Mr. Dickinson's casks should be large, in order to answer his views effectually. He further says, that the tube should never descend in the barrel below the under surface of the head, or otherwise some of the yeast will lodge above the opening of the tube and not escape.

TO SOFTEN AND REMOVE PUTTY.

Take a little nitric or muriatic acid, and spread it over putty; in a little time it will become soft, and may easily be removed. Vinegar will have the same effect on putty as nitric or muriatic acid, but it will require longer time.

LECTURES AT THE ROYAL INSTITUTION.

GENERAL CHARACTERISTICS OF THE METALS.

Lecture 28. Mr. Faraday began by giving a list of the substances now classed as metals, amounting in all to 42, which we do not think it necessary to repeat. He then proceeded to observe, that the seven first on the list had been known to the ancients, which was probably owing to their frequently existing native in the metallic state, and to their being so easy of reduction that any chance operations with fire might bring them under notice. They are also generally diffused. To these metals the ancients gave the names of the planets, and employed the same symbols to designate both. The ancients were also, it is probable, acquainted with zinc, at least in its alloys and ores, but all the other metals are of modern discovery. The name of zinc first occurs in the writings of Paracelsus, who died in 1541. Bismuth is mentioned by Agricola about 1530; antimony was first obtained by Basil Valentine, towards the close of the 15th century; arsenic and cobalt were made known to us by Brandt, in 1733; platinum was first discovered to be a distinct metal by Mr. Wood, Assay Master in Jamaica; we are indebted to Cronstedt for a knowledge of nickel; and Gahn was the first who obtained manganese; tungsten was discovered by M. Delhuyart, in 1781; tellurium and molybdedum were made known in 1782, by Müller and Hielm; Klaproth discovered uranium in 1789; and in the same year also Mr. Gregor discovered titanium; Vauquelin discovered chromium in 1797; and in 1802 Mr. Hatchett detected columbium; in 1803 palladium and rhodium were discovered by Dr. Wollaston; and iridium and osmium by Mr. Tennant; Hisinger and Berzelius announced the existence of cerium in 1804; and potassium and sodium were discovered in 1807, by Sir Humphry Davy; and this discovery led us to the knowledge of the metallic nature of the bases of the different earths. Thorinum and selenium were announced in 1815 and 1817, by Berzelius; and Mr. Stromeyer, of Gottingen, discovered cadmium in 1818. From these late discoveries we have been led to know that the great crust of the earth consists almost wholly of metallic bodies; but this, though very curious to the geologists, will only, and at an after part of the course, be brought under the notice of the chemist.

Metals occur in different states, some native, and others mixed with various substances. Platinum is almost always found native; silver, gold, mercury, and copper, are also frequently found in this state. The substances which most generally mineralize the metals are as follow. Oxygen, forming with them oxides; there are also a few native chlorides. Sulphur is more frequent, forming with the metals sulphurets, which are important both to miners and chemists. Carburets are rare, but there is one native carburet of iron. With acids the metals, or rather their oxides, are frequently combined, forming an extensive class of bodies, distinguished as salts.

The peculiar characteristics of the metals are lustre, opacity, and being excellent conductors of heat and electricity. Mica, a non-metallic body, possesses a lustre equal to some metals, but it is distinguished from them by not retaining its lustre, which they do, when scratched. The opacity of metals is perfect, though gold, when hammered out very thin, transmits a ray of green light, and as it reflects the yellow rays, this is probably an example of a slight degree of transparency in a metal. It has been remarked, that those metals which are good conductors of heat are also good conductors of electricity. Formerly great weight was thought a characteristic of metals, but among them are now classed some of the lightest, as well as some of the heaviest solids we know. The specific gravity of metals is at no time a good test of them, for it varies even in different

metals, in proportion as they are hammered, or rendered dense, and it is least if the metal be examined after it has been cast. It is difficult, therefore, to determine the exact specific gravity of metals, though this is a matter of considerable importance, particularly now, when some chemists endeavour to show that there is a close and intimate relation between the specific gravity of metals and their proportional numbers; and there is no doubt but this will lead to an experimental demonstration of the specific gravity of all the metals. For determining the specific gravity of all liquids and solids, water is assumed as unity, and the specific gravity of any body is determined by ascertaining its weight in air and in water; and the sum of its weight in air being divided by the weight it lost in water, the quotient is its specific gravity. A metal, for example, weighs in air 360 grains, and in pure water, at the temperature 60°, 240, or it loses 60, then $360 \div 60 = 6$, the specific gravity of the metal. This is a rough outline of the theory; in practice it is a matter of great nicety, and requires skill, care, and numerous precautions. Metals vary much in their malleability and tenacity, and gold is so malleable that it has been hammered into a leaf not being more than 1-280,000th part of an inch thick. Some metals are malleable at one temperature and not at another; thus zinc, which is at the temperature of the atmosphere brittle, is malleable at the temperature of 220°, and what is singular, after being once made malleable, it retains this property at ordinary temperatures, and can be beaten out into thin leaves. Neither the ductility nor tenacity of all metals is proportionable to their malleability. Gold is, indeed, both more malleable and ductile than iron; but copper, though more malleable, is not so ductile as platinum; that is, though it can be hammered out thinner, it cannot be drawn into equally fine wire. Iron again, though neither so ductile nor malleable as gold, is much more tenacious, supporting, according to the experiments of Guyton Morveau, nearly three times as heavy a weight. Some of the metals are less tenacious than several species of wood, paper, leather, &c. This property, more particularly as far as iron is concerned, is now more than ever called into use, in the formation of suspension bridges, chain cables, and other useful instruments; and it is a property which, in the formation of hoops and other similar things, is brought into very general use. Several of the metals are brittle, and break under the hammer, such as antimony, arsenic, &c. None of them are very hard, and some of them are so soft that they can be scratched by the nail. Most of the metals are sonorous, and even lead is so. They are all solids, except mercury, at ordinary temperatures. Such is a brief outline of the physical characteristics of the metals: their chemical properties may also be briefly stated.

All the metals combine with oxygen, some at the ordinary temperature of the atmosphere, others require a very high temperature; and others again the very highest we can produce by the Voltaic discharge, or our best furnaces. They form, in their union with oxygen, metallic oxides, which is a most important class of bodies. Gold and platinum, it may be remarked, are deoxidized, or reduced to the metallic state, by a red heat, and again converted into oxides by a higher temperature. Whenever more than one oxide of a metal exists, it is always found that every oxide after the first contains a quantity of oxygen, which is the precise multiple of the first quantity. Thus, 100 parts of mercury combine with 4 of oxygen to produce the proto-oxide, and with 8 to produce the peroxide. Thus, in the two oxides of copper also, the first contains 12.5 parts of oxygen, and the second 25 parts in the 100 of the metal. To form oxides, metals combine with different quantities of oxygen, though for each metal the quantity is always definite;

thus 1 proportional of oxygen, or its equivalent, 8, combines with 200 mercury, 110 silver, 64 copper, 40 potassa, 28 iron, 24 soda, 10 lithium; and on the principle of mutual saturation, these numbers, therefore, are the equivalents of the metals, or their proportional numbers. The oxides of the metals have different characters, some being bases, and uniting with acids, being insoluble in water; others are acids soluble in water, and unite with bases. Some are colourless, others possess colour, and form some of the most valuable of our pigments. In general the metals of the lowest proportional numbers have the greatest attraction for oxygen, and decompose the oxides of other metals with higher proportional numbers: but this rule is not universal.

Chlorine also combines with most of the metals, and has a greater affinity for them in general than oxygen, decomposing the oxides; and the physical and chemical character of the chlorides are various, like those of the oxides. Iodine also acts on most of the metals, and forms with them iodides. Hydrogen combines, or rather exists in combination with tellurium and arsenic, forming hydrogurets of these metals. When the oxides of the metals combine with water, as the oxide of copper and other oxides do, in definite proportions, they form hydrates. After describing also the action of nitric acid generally on the metals, and remarking as a general characteristic of the nitrates, that they were all soluble in water, Mr. Faraday gave the following list, as the order in which he should treat the separate metals; and we shall be particular in detailing under each the different action of different substances, which will, we think, supersede the necessity of following out more in detail the general remarks. The principle on which Mr. Faraday is to treat the metals, is in the order in which they seem to possess an affinity for oxygen.

1. Potassium
2. Sodium
3. Lithium
4. Calcium
5. Barium
6. Strontian
7. Magnesium.

These seven metals produce alkaline oxides, which are difficult of reduction, and they rapidly decompose water at all temperatures, which shows their powerful affinity for oxygen.

8. Manganese
9. Iron
10. Zinc
11. Tin
12. Cadmium.

These five do not decompose water at ordinary temperatures, and they do when heated to redness.

13. Copper
14. Lead
15. Antimony
16. Bismuth
17. Cobalt
18. Uranium
19. Titanium
20. Cerium
21. Tellurium
22. Selenium.

These ten do not decompose water at a red heat, neither do the five following: in this point, therefore, they agree; but the five differ from the above by forming acids when united with oxygen.

23. Arsenic
24. Molybdenum
25. Chromium
26. Tungsten
27. Columbium.

All the oxides of the above metals are not reducible by heat alone, though some of them do give out oxygen when heated. The nine next in the list, except osmium, have a feeble attraction for oxygen, and they are reduced to the metallic state by heat alone. The last six in the list are placed there chiefly from analogy, being known only in their state of oxides, though the reduction of one or two to the metallic state has been announced.

28. Nickel
29. Mercury
30. Osmium
31. Iridium
32. Rhodium
33. Palladium

34. Silver
35. Gold
36. Platinum
37. Silicium
38. Alumium
39. Zirconium
40. Glucinum
41. Yttrium
42. Thorinum

RAILROADS, AND COMMUNICATION BY WIND.

When there is at present such a vast deal of interest excited on the subject of railroads, and when so many have been projected as will cost, it is said, nearly 30 millions of money to execute, we shall not, we think, be censured by our readers for calling their attention to a pamphlet,* the author of which suggests a mode of communication superior, in his opinion, to that of railroads. It is plain that if there be any method of communication, of which we can avail ourselves, superior to that of railroads in point of cheapness and expedition, it must, whenever brought into notice, supersede them, and render all the capital which may now be employed in making them not only unprofitable but absolutely wasted. To prevent this 30 millions from being thrown away seems to have been the motive of the author, Mr. John Vallance, for publishing at the present moment an account of a method of communication invented by him, though not yet perfected in all its details, so that every matter on which the public may desire information can be fully explained. Thus, for example, the author has not had time, it appears, to complete some experiments he has begun, on making bricks or burnt clay *impermeable* to air; and on his success in this particular point the cost of executing his scheme will in some measure depend. This, therefore, and several minor points of this description, are not explained; the principle is, however, clearly laid down. This we shall allow the author to describe.

"Of all means which nature offers for the communication of motion, there are none that will, in point of economy, compare with air. Its levity, the freedom with which its particles move among themselves, and its expansive principle, render it so faithful a communicant of any impulse imparted to it, that if we can but arrange methods of commanding and directing its operation, we may both communicate motion from large stationary engines to vehicles, at very much less expense than carriages have yet been driven for, and cause those vehicles to move with a velocity we have hitherto had no instance of.

"Now, difficult as it may at first be deemed, to command the motion and direct the operation of air, an examination of our resources will prove it not so impossible as it appears. There is a certain manufacturing purpose, for which air-pumps are frequently made, of a size, compared with which, the air-pumps made by philosophical instrument-makers are as pocket-pistols to forty-eight pounders. Many of these pumps will exhaust several thousand cubic feet of air per minute; and there is one, of above eleven feet in diameter, and with an area of 100 square feet, which, supposing its piston to move at the same rate as that of the steam-engine which works it, would exhaust 22,000 cubic feet of air per minute. If it is possible to make one such air-pump as this, it is possible to make ten, or any other number of them.

"A dozen, operating simultaneously, would exhaust to a degree, that would cause air to rush toward them at the rate of thirty miles an hour, provided the course or channel, by which the air reached them, could be confined to an area equal to that of each pump; a circle of about eleven feet diameter, that is; and the force with which this air would press against any thing that impeded its progress, by filling the passage, would

* Considerations on the Expedience of sinking Capital in Railways. By John Vallance.

be, beyond comparison, greater than that with which the most powerful locomotive engine would operate on a vehicle.

"As the same means which enabled us to construct one dozen, would enable us to construct two or more dozen such air-pumps as are here referred to, it becomes incontrovertible that we have the power of *commanding* the *motion* of air to whatever extent we choose to exercise it. Let us now see whether it will be impossible to *direct* the operation of this air.

"In execution of the system, which scarcely more than a dozen years ago was so derided, and exclaimed against as 'impossible,' 'absurd,' and 'madness to think of,' there have been laid down in the metropolis, as 'gas mains,' above 300 miles of cast-iron pipe; * a quantity, which, were it in one continuous line, would reach from one side of the island to the other. The object of these pipes is to direct the motion of a peculiar kind of air to certain spots, where it is wanted for a purpose it answers better than any thing that can be substituted for it.

"We have before us therefore daily, or rather *nightly* evidence, that it is in our power to direct the motion of air. Now, it will not be denied, that had any circumstance held out a prospect of such an increase of expense being repaid, these 300 miles of gas-pipe might have been six feet in diameter as well as six inches; nor that pipe of this or of greater diameter might be laid from one end of the island to the other, should it appear that the enormous expense of doing it would be money well laid out.†

"And as gas-pipes can be put together in a way which renders the joints tight, with reference to a fluid that is lighter and more subtile than common air, it follows, that pipes of the increased diameter referred to might be connected in a similar manner, for any extent we chose to lay them down. It becomes incontrovertible, therefore, that it is equally in our power to give a *direction* to the air, as the steam-engine and pumps which have been referred to enable us to *give motion* to it.

"It can be conceived, that the gas-pipes in London might have been laid in one continuous line, reaching, we will suppose, from the metropolis to Falmouth. It can also be conceived, that pumps, such as have been referred to, could be arranged at the latter place to exhaust air from this line of pipe and cause a current through it. Supposing this to be done, and that there were any very light body, such as a bladder, or rather a hollow copper ball, which nearly filled its bore, in the pipe, would not this ball be driven toward Falmouth at a rate proportioned to the velocity with which the pumps exhausted the air from the pipe. And as it is well known that, by operating on this principle in the proper manner, air may be caused to move with a velocity so great that it may be prudent not to particularize it, have we not a principle of motion held out to us, which, though it might not be one-tenth of the almost inconceivable velocity adverted to for the purpose of illustration, it may yet be possible to elaborate into means of intercourse rapid to a degree of which we have hitherto had no instance.

"The steam-engine gives us power to any extent we choose to exercise it. The same means which enable us to make one such air-pump as has been adverted to, will enable us to make any number of them we may require. And if pipe of six feet in diameter can be laid down for one purpose (certain short water-courses of peculiar construction), it cannot be impossible to lay it down for a purpose such as is here specified.

"Provided, then, it can be *demonstrated* that methods of commu-

"* M. Dupin states, that the water and gas pipes of London are equal to an extent of 1200 miles."

"† This is about to be done, to the extent of three feet in diameter, and 35 miles in length, by one of the new Bath Companies."

nication on this principle would be equally profitable with that of lighting by gas, in comparison with oil or tallow, it is a just inference that they will be adopted, as gas-lighting is adopted. - - -

"By employing that *most sensitive* communicant of motion, air, directing its operation in the way that has been stated, we may convey to a vehicle many miles off, in an almost unimpaired degree, the impulse which a powerful stationary engine will impart; and obtain, not only the advantage which the superior economy of large engines admits of, but also that of increasing the velocity at which we may be conveyed, to a degree which only reflection will give us to perceive possible.

"Supposing a line of large pipes or cylinders, such as have been adverted to, were laid down and connected, (though differently to the manner in which the joints of water and gas-pipes are made, to guard against contraction and expansion,) it may be conceived that a channel (a railway in effect), on which a vehicle might run, could be fixed on the inside of them. As these cylinders would be large enough for a wagon to go in, it may also be conceived that a vehicle, of a description capable of moving on this railway, might be arranged. It may, in addition, be conceived, that instead of being like a coach, the body of this vehicle might be so shaped as to fit and nearly to fill the cylinder; while the inside should give ample room for persons to sit; and the outside actually touched the cylinder in no part but where the wheel ran on the railway. As these things may be conceived, it will not be denied that a vehicle to move inside this cylinder might be so constructed and arranged, as to run equally light with a carriage on a railway."

The principle of this method is, that we should direct currents of air through tubes or apertures laid in any given direction, and allow those currents to carry along with them whatever we choose. We shall offer no opinion on the feasibility of this project. It is evident that there are many difficulties to overcome, of which the author seems fully sensible, and prepared to surmount them by several additional ingenious contrivances. He protests strongly, however, against the usual condemnation of every novelty, on the score of impossibility. No rational man, who knows how many things, formerly called and really supposed to be impossible, have since been executed, will condemn any plan on his own short-sighted view of what now is or may be accomplished. The author concludes with the following appropriate anecdote:—

"Impossible is a word, the value of which is in proportion to the perceptions of those who use it. By the grandees of the Spanish court, it was considered equally applicable to their attempt to stand the egg on its smaller end, as they had deemed it with reference to Columbus' voyage. 'In leaving France,' observes Mad. de Staël, 'it is difficult to grow accustomed to the sluggish inertness of the German people: they never hasten to any object: they find obstacles to all. You have "It is impossible" repeated a hundred times in Germany for once in France.' To minds of this calibre, argument would be useless. Their imbecility may be better met, by stating an occurrence which took place in our first attempt at inland navigation.

"'When the canal was completed as far as Barton, where the Irwell is navigable for large vessels, Mr. Brindley proposed to carry it over that river, by an aqueduct, 39 feet above the surface of the water in the river. This, however, being considered as a wild and extravagant project, he desired, in order to justify his opinion towards his noble employer, that the opinion of another engineer might be taken, *believing that he could easily convince an intelligent person of the practicability of the design.* An engineer of eminence was accordingly called, who, being conducted to the place where it

was intended that the aqueduct should be made, ridiculed the attempt; and when the height and dimensions were communicated to him, he exclaimed, "I have often heard of castles in the air, but never was shown before where any of them were to be erected." This unfavourable verdict did not deter the Duke from following the opinion of his own engineer. The aqueduct was immediately begun, and it was carried on with such rapidity and success, as astonished all those who but a little before thought it impossible; and within twelve months did the crews of the vessels navigating the Irwell see the Duke's barges sailing over their heads, in the channel upborne by this "castle in the air."

Knowing from experience the haste with which accusations of plagiarism are made in the *Glasgow Mechanics' Magazine*, we must, before concluding, observe, that in that magazine a few weeks ago, a plan was suggested for conveying letters, &c. through pipes, on the principle mentioned by Mr. Vallance. In fact, however, Mr. Vallance's plan was publicly mentioned in 1823, though it is only now brought forward by the author in a state fit to meet the public eye. Like every novel suggestion, for no man can at the first blush tell whither a new idea may lead us, it is at least deserving of attention and consideration.

CEMENT FOR IRON PIPES.

For what is termed flanged joints, and all such as are not required to be taken apart, use an iron cement made of iron boring, pounded sal ammoniac, and sulphur, in the proportion of forty of borings to one of sal ammoniac and one quarter of sulphur. The exact proportion, however, can only be ascertained from practice. This composition should be wetted with water or urine, and driven into the joint with a hammer and caulking chisel: it will then be found the most durable of all joints, if well made, and will resist steam of any pressure. If the joints are required to be taken asunder frequently, this cement will not of course, be so convenient, and in such cases a platted rope or gaskin, with some glazier's putty, or white and red lead, will answer every purpose.—*Mechanics' Magazine.*

COLOUR OF AGATES.

The inhabitants of Indostan are said to colour agates artificially, which adds much to their value. They are first boiled in oil, and then in sulphuric acid. This gives to some of the plates or strata of which the stones are composed, a black colour, while the others preserve their natural colour, or even become a brilliant white.

TO CORRESPONDENTS.

"T.S." is informed, that there are frequent opportunities of procuring specimens of natural history, at the auction rooms of Mr. Thomas, King-street, Covent-garden. It is probable that he may find some of the objects after which he inquires, at a sale of BIRDS and INSECTS, to take place, we observe, on the 29th.

"Another Working Shipwright" in our next; as also "J.R.T.," Edinburgh.

We are sorry to learn what "H.M.L." states, and are quite unable to explain the business. The French chemist, whose receipt we gave, is a man of the very highest reputation, and it appeared in the *Annales de Chimie*, &c. perhaps the first scientific journal of the day. We would advise him to make experiments on a small scale, and either diminish the plaster of Paris or augment the lamp-black. His other Queries in our next.

*** Communications (post paid) to be addressed to the Editor at the Publishers'.

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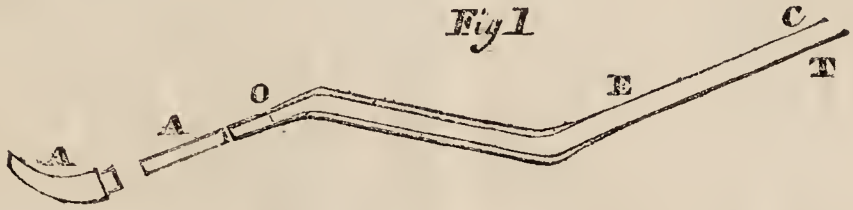

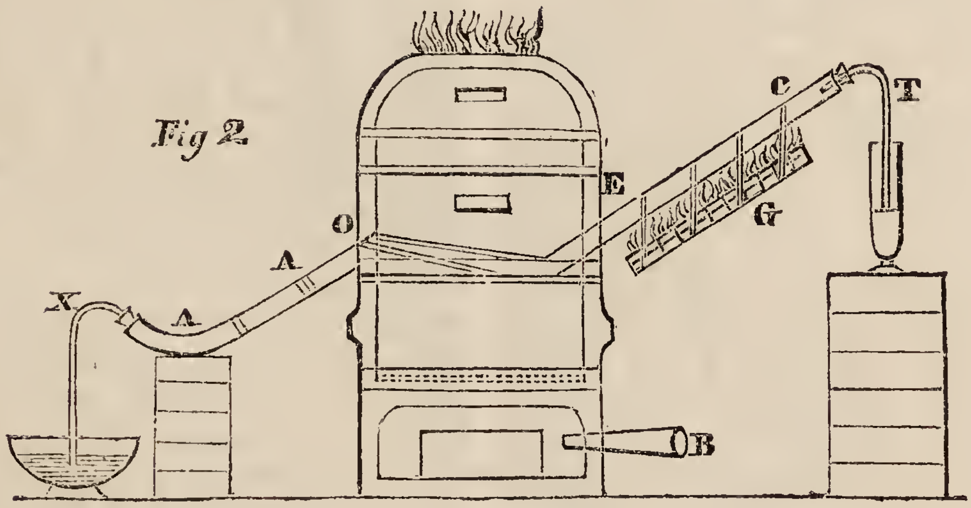

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LECTURES AT THE ROYAL INSTITUTION.

POTASSIUM.

LECTURE 29. The first of the metals to be treated of, Mr. Faraday said, are those which decompose water at all temperatures; and the first of these on the list, potassium, was one of the brilliant results of Sir Humphry Davy's idea of applying the electrical affinities of the Voltaic battery to effect chemical decomposition. It was in 1806 that this distinguished chemist first suggested the notion of employing the Voltaic power to overcome chemical affinities; and it was in 1807 that he justified his own views by instituting a laborious

and ingenious set of experiments, which ended in making us acquainted with the metallic bases of the alkalies. When he submitted a solution of potash in water to the action of the Voltaic battery, the water alone was decomposed, and the alkali remained untouched. On fusing potassa in a dry state, he observed that it burnt with a bright flame, but he obtained no products which he could examine. At length he succeeded by moistening pure potash, and submitting it to the action of the Voltaic battery: he found that metallic globules were produced at the positive pole, and that oxygen gas was evolved at the negative. The battery he employed for this purpose consisted of 150 pair of plates of four inches square, which Mr. Faraday said was then before the class, and with this battery he decomposed all the alkalies. On placing a thin piece of potash in a porcelain capsule, and connecting its under surface with the negative and the upper with the positive pole, oxygen is evolved at one and potassium at the other, the latter being confined by the potash. By this method, however, only very small quantities of the metal can be obtained; and the mode of procuring it discovered by Gay-Lussac and Thenard, in 1808, is now generally adopted in this country. The method they fell on of decomposing the potash by chemical affinity, is so little warranted by ordinary experience, that it is still a matter of surprise to chemists how they came to discover it; and to do so required a great degree of ingenuity. It consists in decomposing potash in conjunction with iron turnings at a very strong heat. The following description and accompanying cut, will explain their mode of operating:—

A sound and perfectly clean gun-barrel is bent, as shown in the annexed sketch. It is then covered with an infusible lute between the letters O and E (fig. 1.), and the interior of the luted part is filled with clean iron turnings. Pieces of fused potassa are then loosely placed in the barrel between E and C. A A is a copper tube and small receiver, which are adapted to the extremity O, and to each other, by grinding. This apparatus is next transferred to the furnace, arranged as shown in fig. 2, X and T representing two glass tubes dipping into mercury. The furnace is supplied with air by a good double bellows entering at B, and a small wire basket G, is suspended below the space E C. The part of the barrel in the furnace is now cautiously raised to a white heat, and the escape of air by the tube X shows that all is tight. Some burning charcoal is then put at the end E, of the cage G, which causes a portion of potassa to liquefy and fall into the low part of the barrel upon the iron. Hydrogen gas instantly escapes by the tube X, and attention must now be had to keep the copper tubes A A cool, by laying wet cloths upon them. When the evolution of gas ceases, fresh charcoal is placed under the potassa, and so on till the whole has passed down; if too much potassa be suffered to fall at once, the extrication of gas at X will be very violent, which should be avoided. If the space between A and O should become stopped by potassium, gas will issue by the tube T, (which must always be under a greater pressure of quicksilver than the tube X,) and it may be fused by applying hot charcoal to the tube, when the gas will again appear at X and cease at T. When the operation is concluded, the tubes X and T are removed, and corks quickly applied to the holes; and when the apparatus is cool, the barrel is carefully removed from the furnace, and a little naphtha suffered to run through it. The potassium is found in globules in the tube and receiver A A, and considerable portions often lodge at O. The success of this operation is certain, if the heat has been sufficient; but the barrel, if not very carefully covered with lute, is apt to melt, and much, if not the whole, of the product is lost.

At the close of the lecture Mr.

Faraday announced that he was then going to perform this experiment, and procure potassium, if any of the students chose to stay. He accordingly performed it, producing an intense degree of heat in a little furnace, constructed of bricks by himself, under the chimney of the laboratory. It was not, however, very successful, only a small quantity of potassium being obtained, in consequence of the luting and iron of the barrel expanding unequally, the lute breaking in pieces and falling off, and the potassium escaping. Some was obtained. Another method was recommended by Mr. Curandau, of Geneva, which consists of fusing potash with charcoal in a strong iron pot, to which a bent iron gun-barrel is adapted. This method is followed on the Continent, and the celebrated Swedish chemist, Berzelius, is said to have made half a pound at one time by this means. It is made with such facility as to be sold in every apothecary's shop in Sweden. Potassium is a white metal of great lustre, and is instantly tarnished by being exposed to the air. It is speedily oxidated also, and is preserved, therefore, under naphtha. It must be put into a bottle closely corked, and should be rather moistened all over with naphtha than immersed in it. Even in naphtha it is altered. The potassium obtained by Gay-Lussac's method is not so pure as that obtained by the Voltaic battery; it is always heavier, and not so bright: to what this is owing has not been explained, but the fact is ascertained. It is ductile, and soft almost like wax. Its specific gravity, as compared to water 100, is 87. At a temperature below 0° of Fahr. it is a crystallized brittle solid; at 150° it fuses, and at 450° it volatilizes and rises in vapour. It possesses the property of welding like iron. When burnt it emits a bright emerald-coloured flame. It is a good conductor, both of heat and electricity. From the air it absorbs oxygen, and to obtain this it decomposes water. It catches fire very readily, and if a piece of it be rubbed on brown paper with any hard substance, it instantly inflames. To perform this experiment, it is only necessary to place a small piece of potassium on paper, and rub it backwards and forwards with a piece of wood. When burned with oxygen it forms a substance soluble in water; and when thrown on water it catches fire, bounces about, and forms a substance which is dissolved in the water. If this experiment be performed beneath a vessel in the pneumatic trough, we obtain the hydrogen which results from decomposing the water, and this becomes a measure of the quantity of oxygen combined with the potassium.

From experiments conducted in this way with great care, it has been ascertained that 100 parts of potassium combine with 20 of oxygen, or 40 parts of potassium absorb 8 of oxygen. Supposing this to be the protoxide, the proportional number for potassium is 40, and 40, with 8, the oxygen, = 48, represents the dry oxide of potassium, or pure potash. Caustic potash, as it is usually found, contains a quantity of water, and is a hydrate of potassa. The water cannot be separated from this oxide by means of heat alone; it requires to be decomposed, and then it is converted into a hard grey substance, which is again converted into the hydrate by the action of water. The hydrate may therefore be considered as a chemical compound. There is another compound of potassium and oxygen, which may be considered as the peroxide. It may be obtained by burning potassium in excess of oxygen, or by exposing the already formed oxide when heated to oxygen; a yellow orange-coloured substance is found, which contains three proportionals of oxygen, and may be considered as a peroxide of potassium. When it is put into water it effervesces, oxygen is given off, and the protoxide remains in solution.

The *hydrated protoxide*, or caustic potash, is obtained by boiling the

purest sort of pearl ash (carbonate of potassa) in clean iron vessels, with half its weight of quick lime: the lime takes the carbonic acid; the mother liquor is to be strained through clean linen, concentrated by evaporation, again strained, and set by to cool in a close vessel. When the liquid can be decanted clear from the sediment, this is to be done, and the solution evaporated to dryness. It may be further purified by the action of alcohol, which dissolves the potash, and leaves the other substances it is usually mixed with untouched. The alcohol may then be evaporated in close vessels, so as not to be lost, and the caustic potash is then obtained pure. In this state, however, it usually contains some peroxide, and when dissolved in water gives out oxygen. The scum which generally forms on the surface of the solution is almost wholly oxygen. The caustic potash of commerce almost always contains silver and lead; the former is probably derived from the vessels in which it is purified, while the origin of the latter is unaccounted for.

This hydrate of potassa, or caustic potash, in its greatest state of purity, is white, very acrid and corrosive, and if handled destroys the cuticle, and acquires a soapy feel. Dissolved in water, it produces a considerable degree either of heat or cold, as it may have been prepared. If put into water in its fused state, heat is the result; but if it have been crystallized, on being mixed with water, and particularly if mixed with snow, it produces a degree of cold sufficient to depress the thermometer more than 40°. This difference, therefore, depends on the presence or absence of water in the potassa; and if it be already present, cold is the result of the solution. Potassa possesses all those properties to which the name of alkaline has been given: it reddens vegetable yellow colours, and turns blues to green. It dissolves soap. It may be obtained in a crystalline state. As already stated, the water exists in it in chemical combination, and it is therefore a true hydrate. On this principle, it is a compound of one proportional of water and one of dry oxide, its equivalent being 57; or it is one proportional of the metal potassium, 40, combined with two proportionals of oxygen, 16, and one proportional of hydrogen. The peroxide consists of one proportional potassium, 40, and three proportionals of oxygen, 24, and its equivalent is 64.

Chlorine acts on potassium even more energetically than oxygen; the metal takes fire when put into the gas, though sometimes, owing to a film of the resulting compound forming a crust over the metal, the action stops, but is renewed and continued if the metal be heated. In this compound we find one proportional of potassium, 40, combining with one of chlorine, 36, and forming a chloride of potassium, represented by 76. This compound is a strong proof of the chemical doctrine of proportionals or equivalents, as we find potassium combining with precisely that quantity of oxygen and chlorine, which in a former part of the course have been mentioned as combining with one proportional of hydrogen. The chloride differs from the oxide of potassium in possessing no acrid or intense powers. Its taste is saline and bitter, without possessing any active properties, and it crystallizes in cubes. The chlorine and potassium completely neutralize each other, and the active properties of both disappear. Formerly this was called *salt of silvius*, *regenerated sea salt*, and *muriate of potash*. Since the year 1807, however, its true nature has been known, and it is now called, more correctly, chloride of potassium. It is generally obtained by the mutual action of muriatic acid and potash, and was therefore called muriate of potash; and as many other chlorides have, like this, been supposed to be oxides united with muriatic acid, I may take this opportunity, Mr. Faraday said, to explain the origin of this mistake.

When potassium is heated in muriatic acid,—when potash is mixed with liquid muriatic acid,—when potassium is burned in chlorine,—we have always the same substance produced, or the chloride of potassium. The fact is, that in all these cases the chlorine unites with the potassium, and the hydrogen of the muriatic acid and the oxygen of the oxide form water. The chloride of potassium is not a compound of any importance but to the speculative and analytic chemist.

Chlorate of potassa, or, as it was formerly called, oxymuriate of potash, is obtained by passing chlorine through a solution of potassa; the oxide and the chlorine unite, and a salt is obtained, which is crystallized in brilliant rhomboidal tables. It is a compound of 6 proportionals oxygen, 48, five in the chloric acid and one in the alkali, 1 proportional potassium, 40, and 1 of chlorine, 36, its equivalent being 124. It has a salt taste, resembling nitre, and from the quantity of oxygen it contains, is employed to procure this gas in a pure state. It gives out pure oxygen when heated, and chloride of potassium remains. It is by decomposing it in this manner that its composition has been learnt. It acts very energetically with many inflammable bodies, and triturated with charcoal, sulphur, or phosphorus, inflames and explodes. A mixture of three parts chlorate and one sulphur, if struck with a hammer, or rubbed together in a mortar, explodes; and care must be taken in making this experiment not to take too much, as there is a risk of breaking the vessel. With phosphorus the explosion is still more violent. When sulphuric acid is brought into contact with a mixture of this salt and combustibles, instant ignition ensues; and it is on this principle instantaneous light machines are constructed, which are now so well known. There was at first some danger and unpleasantness from the use of sulphuric acid, but this is now obviated by putting asbestos into the bottle for the sulphuric acid. The chlorate of potassa mixed with sulphur to form the matches, and sulphuric acid to immerse them in, form perhaps, altogether, the best instantaneous light machine which has yet been invented.

Chlorate of potassa mixed with muriatic acid, and diluted with water, forms an excellent bleaching liquid, which may be instantly made. Mr. Faraday styled it an extemporaneous bleaching liquid. We have only to put a few grains of the chlorate into a tea-spoonful of muriatic acid, and dilute with water, and it will remove almost all kinds of spots.

A curious experiment which Mr. Faraday made with the chlorate, was mixing a small quantity of it with twice its weight of sugar, and then pouring on it a drop or two of strong sulphuric acid, when a sudden and vehement inflammation, with much light and heat, instantly ensued: but this experiment must be made with caution. In conclusion, Mr. Faraday said he was going to make potassium, and invited the class to witness the experiment already detailed.

ENGRAVING ON STEEL.

For this purpose it is necessary that the steel should be as soft as possible, and Mr. Perkins has accomplished this by an ingenious contrivance. He encloses the steel in a cast iron box, the sides of which are eight or nine lines in thickness, and which can be perfectly closed. The steel is laid in a bed of filings of pure iron, about six lines deep, and is also covered with the same material. The box is then placed in a forge fire or furnace, and kept nearly at a white heat for four hours. It is then allowed to cool very gradually, remaining in the fire till it is extinguished. By this means the steel loses its carbon, and becomes quite soft. The impression or engraving, whatever it is to be, is then made on it, and the steel is recarbonized. It is placed in a box, like the one described, and covered all over,

about an inch thick, with animal charcoal in a state of powder. The box is again placed in the fire, and kept red hot from three to five hours, according to the thickness of the steel. It is then immediately tempered. It is by these means that Mr. Perkins imparts excellent impressions to steel plates in their soft state by machinery, which, when afterwards hardened as described, will give almost any number of impressions, unaltered.

GAS IN MINIATURE.

Put a small quantity of common coal into the bowl of a tobacco-pipe; cover over the mouth of the bowl with clay made into a paste with water. When the clay is dry put the bowl of the pipe into the fire, and heat it gradually. In a few minutes a stream of gas will issue from the tobacco-pipe, and may be lighted. It burns with a bright flame. With it there comes over an aqueous fluid and a tenacious oil or tar; and after the gas ceases to come over, the bowl of the pipe is found to contain coke.

POLISHING STEEL ORNAMENTS.

It is well known to our readers that a great number of ornaments and small articles of jewellery, if we may use the phrase, are made of steel, very highly polished. Formerly this branch of art was chiefly confined to England. At present, though larger works, both in steel and iron, are generally better executed here than in France, the small sort of articles, or steel jewellery, is admirably made in that country. The following is said to be the method by which this sort of work is polished. A number of small articles are placed in a hollow cylinder, with emery, freestone, or bath bricks, common bricks, glass, oxide of iron, &c. all ground with water, and made into a soft paste. The cylinder, of which in a manufactory of this kind there are several, is turned by machinery, and the steel articles are in the first instance turned round for the space of 36 hours. They are withdrawn, washed, and again turned for 24 hours more, in quite a dry state, in another hollow cylinder with red ochre, oxide of tin (putty), and black oxide of iron. By this process a brilliant polish is obtained.

CHEAP HYGROMETER.

To the Editor of The Chemist.

Sir,—I hope you will favour this communication with a place in your respectable and useful Journal, as it treats on a subject that you have not yet noticed, except in a general way; and fulfils one of the requisites of your judicious plan, by furnishing those who have more zeal for science than pecuniary means to cultivate it, with what, I trust, will be found a cheap, correct, and sensible instrument.

Having, some years ago, had occasion for a hygrometer, in the course of some electrical experiments, and being aware of the objections to most of those in common use, I endeavoured to construct one for myself, and now send you an account of it; and can assure you, that for both accuracy and sensibility, it answers all the purposes for which I intended it.

There is a substance often cast on the shores of the Frith of Forth, of the appearance of dried hops, or brought in on the nets of the Newhaven fishermen, which, by its extreme lightness and extensive surface, is excellently adapted for forming a hygrometer: it is the empty vesicles or integuments of the spawn of the buccinum. I take about 50 grains in weight of this substance, and cleanse it well with rain water, from salt and sand, and then dry it in the Bachelor's oven; I then soak it well in a saturated solution of subcarbonate of potash, dry it again, and soak it in a saturated solution of carbonate of soda, and dry it for a third and last time as above. I have here chosen two salts that can have no chemical action on one another, one deliquescent and the other efflorescent, so that the instrument has an equal tendency to absorb and to give out

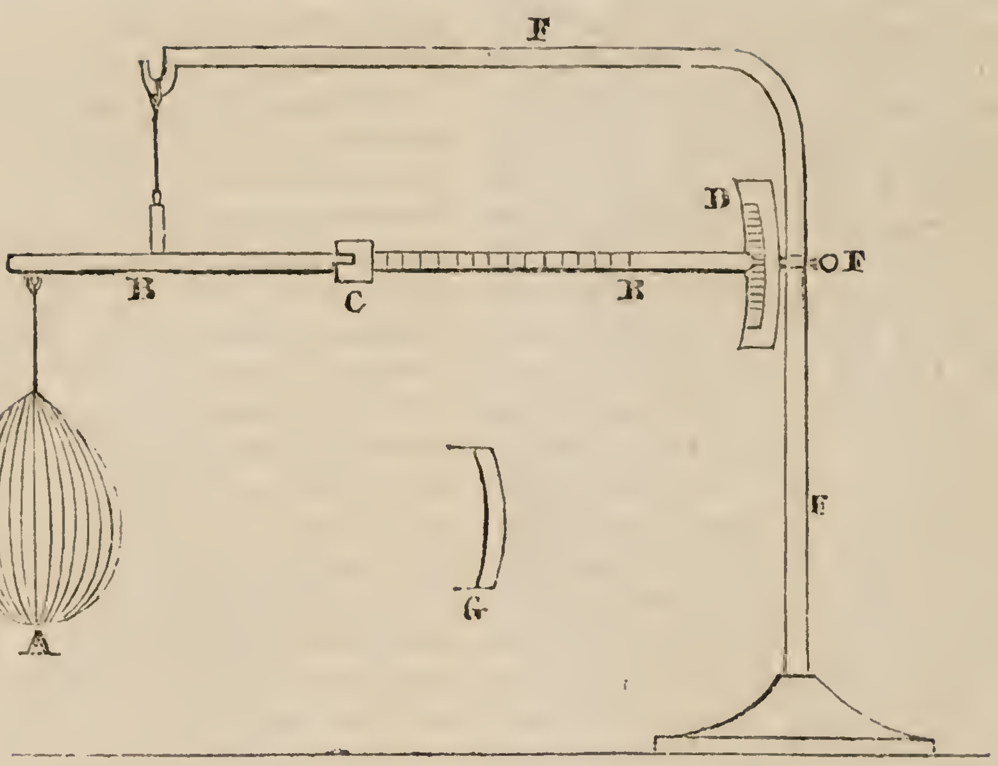
moisture to the atmosphere according to its different states; and, in fact, I see no change on its sensibility, though I have had it for several years in constant use.

I now put the prepared hygrometer, in a silk gauze bag, into the receiver of an air-pump, and after it has remained a sufficient time in the vacuum, along with muriate of lime or sulphuric acid, so as to reach the point of extreme dryness, I weigh it again as quickly as possible, and opening the mouth of the bag, which is drawn by a silk thread, I cut off as much of the substance (which has now increased considerably by the addition of the alkalies) as may reduce it exactly to fifty grains, and suspending it to the steelyard (of which a drawing and description is subjoined), I move the sliding weight till it appears to be in equilibrium, by the index on the fulcrum coinciding with the silk thread on which it is hung. I now have got a beginning to my scale; and to procure the first degree, I mark that point where the nick in the slider stands, and add a grain to the weight of the hygrometer; and then drawing the slider till the equilibrium is restored, I find the size of the degree by the distance the nick stands from the first mark. It is considerably more difficult to get the point of extreme moisture; but I have never found it to exceed one-third of the weight of the whole; therefore 17 degrees will be sufficient to mark on the scale of the steelyard. The micrometer scale on which the end of the steelyard plays, has a kind of bridle, to keep it from moving; and the scale is divided into 20 parts above nothing, in the manner after to be described, and as much space is left below 0, for a sufficient oscillation. Thus, suppose the whole to weigh 50 grs. $+ 20 = 1000^{\circ}$, the greatest increase being 17 grs. $+ 20 = 340^{\circ}$. But Saussure has found, that atmospherical air, at the medium pressure and temperature, holds 11 grains of moisture in solution (when saturated) in the cubic foot; therefore, what is a singular advantage, this instrument will show 1-30th of a grain nearly in the cubic foot of moisture for each degree.

To find the degrees of the micrometer scale, immediately on adding the grain I mark where the end index rises on this scale; this space, divided into twenty parts, having been set by means of its screw, with 0 opposite the end of the steelyard in equilibrium, it must be marked 5, 10, 15, and 20 degrees. The steelyard scale is to be marked at every fifth degree, 100, 200, 300, and 340, at its termination. When the first degree is found by adding the grain weight, and the range of the micrometer found, I add 16 grains at once, and move the sliding weight so as to restore the equilibrium; the space on the steelyard must then be divided into 16 equal parts, besides the first degree, which will be more accurate than making them one by one. The gauze cover effectually excludes the dust from the inside, and from the outside it may occasionally be blown off. But the gauze may be omitted altogether, at the expense of a square glazed box, the free air being carefully admitted through a series of round holes, formed in the lower part of the wooden frame.

I hope soon to furnish you with an account of a number of new and singular experiments on electricity, easily repeated by means of a cheap and simple apparatus, to be described (the grand desideratum of your plan), and of the importance of which you may form some opinion, when I say, that I think I shall be able to make it probable, that electricity is a compound of magnetism, light, and heat; that the first of the compound comes with the two last directly from the sun; and the differences of the rays in the solar spectrum are, that the red is a compound of light with the greatest quantity of heat and magnetism, and the violet with the last.

I am, Sir,
With the greatest respect,
Your most obedient servant,
Edinburgh, March 12. J. R. T.



A, bag containing hygrometer; B B, divided steelyard; C, sliding weight; D, scale on which the end index of the steelyard plays, dividing its degrees into 20 parts each; E, screw to shift the scale up and down, till its middle or 0 coincides with the end of the steelyard in equilibrium; F F, the standard, with a solid foot loaded with lead; G, bridle or curb to keep the end of the steelyard from side vibrations. This must not be put on the micrometer scale till the divisions are made, which need only be above 0, as those below would require to be subtracted, which would be inconvenient.

QUERIES.

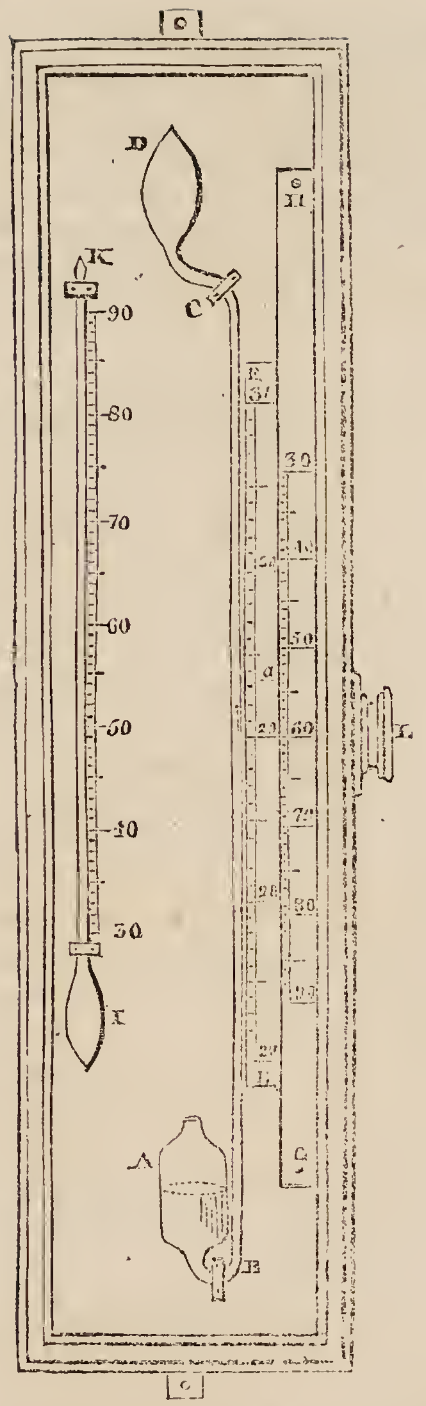
To the Editor of The Chemist.

Mr. Editor, — Being a subscriber to your work, The Chemist, I have seen that you have lately devoted a part of its pages to the inquiries of the inquisitive of all classes. Give me leave, therefore, to ask your respectable and intelligent correspondents the easiest, cheapest, and best mode of making Composition Rollers, which are now generally used instead of balls, by printers? Likewise, if there could not be a better solution than that of potassa, both for separating new types and for removing the greasy substance which generally follows the washing of the old types. The "Means of separating Types," inserted in your 46th No., will not, in my opinion, answer the purpose, as it will occupy a great deal of time and trouble, to say nothing about its face being battered by boiling it in any thing of a hard substance; and should your correspondents feel desirous of answering the above, it will be considered by all printers as an excellent acquisition to that inestimable art, printing.

J. N.

P. S. How to make Printers' Ink, so as to give it a lasting jet black appearance? This would not only be a benefit to printers, but to the public in general, as the inferior ink which is now used not only prevents the printer from pulling off good impressions, but a short time after it is used it turns yellow, by which means the matter is often illegible.

How to make Ginger Beer Powders? they are sold by some druggists.



MR. ADIE'S SYMPIESOMETER.

An improved portable barometer, or rather a substitute for that instrument, has lately been invented by Mr. Adie, of Edinburgh, which we shall shortly describe in the words of the inventor himself, as stated in the patent. The principle of the instrument, which Mr. Adie has denominated a *Sympiesometer*, consists in measuring the weight of the atmosphere by the compression of a gaseous column. It consists of a tube of glass, A B C D, of about 18 inches long, and 0.7 of an inch diameter inside, terminated above by a bulb D, and having the lower extremity bent upward, and expanding into an oval cistern A, open at top. The bulb D at the upper extremity being filled with hydrogen gas, and a part of the cistern A and tube B C with almond oil, coloured with anchusa root, the enclosed gas, by changing its bulk according to the pressure of the atmosphere on the oil in the cistern, produces a corresponding elevation or depression of the oil in the tube, thereby indicating the variations in the weight of the atmosphere. The scale for measuring these changes is determined by placing the instrument along with an accurate barometer and thermometer, in an apparatus where the air may be condensed or rarefied, so as to make the barometer stand at 27, 28, 29, 30, or any other given number of inches. The different heights of the oil in the tube of the sympiesometer corresponding to these points being marked on its scale E F, and the spaces between being divided into a hundred parts, these divisions correspond with hundredths of an inch, on the scale of the mercurial barometer. To correct the error that would arise from the change produced in the gas by a change of temperature, the principal scale E F is made to slide upon another G H, so graduated, as to represent that change, and corresponding to the degrees of a common thermometer I K attached to the instrument. In this state, the rule for using the instrument is simply to observe the temperature by the thermometer, and to set the index *a*, which is upon the sliding scale, opposite to the degree of temperature upon the fixed scale, then the height of the oil, as indicated on the sliding scale, will be the pressure of the air required. The sliding scale E F is moved by means of the knob L.

TO PREVENT WORT BECOMING VINEGAR.

In summer, the last infusion of the malt in brewing is apt to run into the acetous fermentation, and become vinegar instead of beer. To prevent this, a small quantity of hops put in it in a bag is found effectually to answer the purpose.

DICTIONARY OF CHEMISTRY.

HONEY-STONE, *mellite, crystal-harz, pyramidal honey-stone.* A mineral of honey-yellow colour, which is made negatively electrical by friction. It consists of 16 alumina, 46 mellitic acid, and 38 water.

HOOFS of animals consist of coagulated albumen, a little gelatine, and phosphate of lime.

HORDEIN. A name given by Proust to something which he found in barley, and described as a distinct vegetable principle, but is supposed to be only a variety of starch.

HORN, like hoofs, consists of coagulated albumen, a little gelatine, and phosphate of lime. The horns of the buck and hart are different, being intermediate between horn, as just described, and bones.

HORN SILVER, *chloride of silver.*

HORNBLENDE, *augite.* A mineral rather widely diffused. Mineralogists distinguish three species,—the common, hornblende-slate, and basaltic hornblende. Its constituents are silica, alumina, lime, magnesia, oxide of iron, and water.

HORNSTONE, *rhomboidal quartz, splintery hornstone, woodstone, conchoidal hornstone, hornstone porphyry.* This mineral is sometimes cut into ornaments, vases, candlesticks, &c. It is generally hard and susceptible of polish. It occurs in veins along with metallic ores.

HORSERADISH ROOT seems to derive its peculiar properties from an oil, which may be obtained by distillation, and is denser than water.

HOUSELEEK is remarkable, as yielding malic acid, which is so abundant in apples.

HUMITE. A reddish-brown mineral, so named after Sir Abraham Hume.

HYACINTH, *precious pyramidal zircon,* which is one of the gems softer than the topaz. It occurs abundantly at Ceylon, near Pisa, and near Lisbon, and consists of zircon 70, silica 25, oxide of iron 0.50, loss 4.50. The darker coloured hyacinths are deprived of their colour by heat, and are made to resemble diamonds.

HYACINTH OF COMPOSTELLA.—Small crystals of quartz, tinged with iron, and named from the place where they are found.

HYALITE. An ornamental stone, found at Frankfort on the Maine, which consists of only silica and water.

HYDRARGYLLITE, *wavellite,* consists of alumina, phosphoric acid, and water. It is found in Devonshire.

HYDRARGYRI NITRICO OXIDUM, *peroxide of mercury* with a small portion of nitrate of mercury adhering to it, used as an escharotic.

——— OXIDUM RUBRUM, *precipitate per se, calcined mercury, red* or *peroxide of mercury.*

——— OXYMURIAS, *perchloride of mercury, corrosive sublimate.*

——— PRECIPITATUM ALBUM, *calx hydrargyri alba, white precipitate.* Triple muriate of ammonia and mercury.

——— SUBMURIAS, *calomel, submuriate of mercury, protochloride of mercury.*

——— SULPHURETUM NIGRUM, *Ethiop's mineral, black sulphuret of mercury.*

——— SULPHURETUM RUBRUM, *vermilion, cinnabar,* or *sulphuret of mercury.*

HYDRARGYRUM, whence all the above compound terms are derived, is a name given to mercury.

HYDRATES. Substances which combine in definite proportions with water, are, when so combined, called *hydrates.*

PRINCIPLE OF THE BAROMETER.

(*In answer to a Correspondent.*)

THE barometer, as our Correspondent knows, is an instrument for measuring the changes which take place in the weight of the atmosphere. The principle upon which it is constructed may be explained by a very familiar example. If a tube, open at both ends, with a piston exactly fitted to it, have its lower extremity to which the piston has been previously pushed

down, immersed in water, on drawing up the piston, the water will follow it, and continue to do so till it rises to the height of about 33 feet. The same thing will take place if the tube be immersed in mercury, with this difference, that the mercury will ascend only to about the height of 30 inches. The effect in both cases is produced by the weight of the atmosphere. By drawing up the piston, the pressure of that weight is removed from the portion of the fluid immediately under it, while it continues to be exerted on the surface of all the rest. The liquid is therefore forced up into the tube, till the column be of such a height as to balance the weight of the atmosphere. If a glass tube of convenient length, and open at one end, be filled with mercury, and then inverted perpendicularly into a basin of mercury, so that the open end may be under the surface, the mercury will sink down from the upper extremity, and stand at the point to which it would have risen, had a piston been employed as stated above, or about thirty inches above the level of the mercury in the basin. In this form it constitutes a barometer, and the changes of weight which the atmosphere undergoes, are indicated by the rising and falling of the mercury in the tube. To measure these variations, a scale may be placed parallel with the tube, and divided into inches and decimals, beginning at the surface of the mercury in the basin. It is obvious, however, that if the scale be fixed, when the mercury sinks in the tube, the surface of that in the basin must rise in proportion to the relative width of the basin and the tube, and consequently stand higher than the commencement of the scale; and in like manner, when the mercury rises in the tube, the surface of that in the basin must sink, and stand lower than the beginning of the scale. In the one case, therefore, the mercury in the tube will stand at a higher, and in the other at a lower point than it ought to do. This inaccuracy is in part removed, by making the basin very wide relatively to the tube, but still more effectually by constructing it in such a manner that the surface of the mercury in the basin may be raised or depressed to the commencement of the scale. In general a portion only of the scale is divided, viz. from the twenty-seventh to the thirty-first inch, reckoning from the surface of the mercury in the basin, because these are found to be the ordinary limits of the barometrical range.

To satisfy 'Edward' that it is the pressure of the air which supports the mercury in the tube, let him cover one end of the open tube just mentioned with a slip of bladder, fill it with mercury, and place it inverted in the basin with mercury. The bladder will be found concave or pressed in towards the mercury. When in this state, if he punctures the bladder the mercury will instantly fall into the basin, the air which enters the tube by the hole being equal in weight to that which presses on the mercury in the basin, and supports the column in the tube.

PREMIUMS FOR DISCOVERIES.

We are induced to notice this subject by observing, that a gold medal was awarded in the year 1824, by the Scientific Society of Haarlem (Holland), to a Mr. W. Bailey, iron-manufacturer, London, for his description of a method for cultivating fruit in hot-houses. His paper was written in English; and thus we may say, that rewards for skill and ingenuity may be obtained from every part of Europe. Some of our readers may probably be able to obtain a share in the rewards the Haarlem Society offers every year, or at least try for them; and we shall, therefore, bring them under notice. Answers to the following questions must be sent before January 1st, 1826:—

1st. What has been proved with regard to the gastric juice of the human body, and with regard to its effects on the digestion of food? Is its existence proved by the experiments of Spallanzani and Senebier, or rendered doubtful by those

of Montegre? What have we learnt from comparative anatomy, and particularly from the opening of the bodies of animals killed for this purpose, both after taking food and while their stomachs are empty? And, supposing the existence of the gastric juice fully proved, what circumstances must be avoided in order not to weaken its effects in digestion?

2d. What do we know of the nature, habits, and generation of those small insects, which do so much mischief to hot-house plants and trees; and what means does this knowledge point out, in order to prevent or lessen as much as possible the increase of these insects, and clean the plants already affected by them in the speediest manner?

3d. Is it proved by experiment, that there are some plants and trees, particularly among the most useful ones, which cannot or do not grow well when near one another; and what experience can be brought to justify such an opinion? Can the dislike of some plants for others be explained by what we know of their properties? What rules can be given in this respect for the cultivation of trees and other useful vegetables?

We shall transcribe the other questions in our subsequent Numbers.

THE MINERAL CAMELEON.

Take one part of the black oxide of manganese and three parts of nitrate of potash, both being reduced to the state of power; mix them, and throw them into a red hot crucible, and allow them to continue there till no more oxygen is disengaged. A greenish friable powder is obtained, called mineral cameleon. Put a small quantity of it in a glass of water; at first the solution is blue, then yellow, then blue again, and then it becomes reddish, brown, and at last black. The whole subsides, and the fluid is then colourless. If hot water be poured on this substance, a beautiful green solution will result; if cold water be used the solution will be of a deep purple.

NAVAL ARCHITECTURE.

To the Editor of The Chemist.

Mr. Editor,—I have often, with a deal of pleasure, perused your little Publication, in which you, with great judgment, illustrate theory by experiment. By the variety and usefulness of your subjects, you at once please the imagination and instruct the understanding. By directing our admiration to the works of an Almighty hand, which you show has formed every particle of matter for the wisest purposes, you teach us to

Look through nature up to Nature's God.

You have also lately, with a kindness for which you are entitled to the thanks of a numerous and useful, but ill-used class of society, made your Publication conducive to justice, by inserting the letter of "A Working Shipwright," in reply to the assertions of Alpha, in that pompous register of useless knowledge, called the Quarterly Journal of Science.

The Working Shipwright certainly shows in many instances the deficiencies of the persons whom Alpha praises, but still only in points of minor importance: he also complains very feelingly of the wrong suffered by those of ability in the profession, being shut out from preferment, and having their children deprived of their birthright. But this is a wrong easily excused; for it may be said, and justly too, that the interest of the country and not that of individuals should be consulted: and let it be so, every reasonable man must exclaim; but every reasonable man will also say, let them in whose hands such interest is to be placed first give evidence of their ability. Let them then, whom Alpha praises, before the least credit be given to his assertions, show to the world that they possess that almost omnipotent power, which their sapient admirer ascribes to them, of determining with precision the various properties of that complex body, called a ship, which even the immortal Newton thought impossible, and that the person most likely in any degree to succeed, was the man of practical experience. Let them show why the Regent, a royal yacht, upon the construction of which, it cannot be doubted, all the skill of the infallible academy was bestowed, failed in every respect.

Her they wisely resigned into the hands of the sons of imperfect experience, as the sagacious Alpha deems them; who trimmed her up a little ship-shape; shortened her masts, which had sprouted from the magical calculus; put a little more ballast into her hold, and thus saved her from total condemnation: but, I believe, not all the skill of a Chapman, a Bouguer, and an Inman, united with the most perfect experience, could ever so alter her as to rescue her miscalculating constructors from contempt. She is now at Deptford, a gilded monument of their folly.*

The practical shipwrights, Mr. Editor, from among whom the constructors of that navy were chosen, which subdued a whole watery world, were, it is true, not all classical men; nor did they, perhaps, on every occasion express themselves with elegance and precision; but they all had learning sufficient to perceive, that the views of the mere theorist were like the "day dreams of a maid in love." The light of science always invigorated and guided them in their duty, but their experience prevented it from dazzling them by its too frequently illusive blaze; and no instance can be given of their entirely mistaking, like their scientific competitors, a cloud for a Juno. Alpha indeed asserts, that some of the students combine great practical knowledge with their theory; but who they are, how they obtained it, or how he was enabled to determine it, being a secret, it is of course doubtful.

To talk to an able practical shipwright of predicting the displacement, stability, weatherly qualities, and other essentials of a large ship, by calculations made (as is the case in all calculations) from a drawing on a small scale, is only making a laughing-stock of one's-self; when it is well known, that of several ships built by the same moulds, in the same yard, and under the direction of the same persons, with, no doubt, every possible care, no two have been alike in their properties; nay, that they have even differed in their lanching draught of water. This to the scientific Alpha may seem wonderful; but so do many things to those who take upon themselves to write about, and talk about things with which they are only scientifically acquainted. What makes the matter still more laughable is, that the whole of their calculation of stability, &c. is founded on a centre of gravity, which they assume, and which may be almost any where but where they place it. Of old, nothing conveyed a more ridiculous idea of man's folly than comparing his attempts to building his house upon a sand; but what should be said of our modern theorists, who think it nowise absurd to attempt the construction of a whole navy upon nothing?

Alpha seems to ground all his assertions on the comparative perfection of the trial ship lately constructed by the academy; but, I ask, in what is she better than many others? or is she equal to many of the old construction? Besides, he knows nothing, or at least says nothing, of the abortive attempts; but, I believe, the whole on both sides may be fairly stated thus: formerly one ship out of ten might be bad, and now (should we trust to the academy) one of ten may be good.

If science, Mr. Editor, really possesses such potent powers as its advocates presume, how was it that the French ships, constructed by the rules of those very persons

* We have heard of several other instances besides that of the Regent, which is a well-known case of the total failure of some late efforts of mere scientific shipwrights. By the way, what has dancing to do with building ships? as we observe that, for the students at the college at Portsmouth, a dancing-master is kept, who is paid 100*l*. per annum, and a fencing-master, who costs an equal sum. Our Correspondents, the Working Shipwrights, will be happy to hear of the great skill of their future masters. Their heads are fashioned by the knowledge of Euler, their feet move only by the science of Vestris, and their hands are guided in their graceful motions by the skill of a d'Eon.

from whom our schoolmen derive all their knowledge, were never long able to escape the merciless fangs of our sailors? Perhaps they possessed some attractive powers, which Alpha can explain. Courage and skill in battle will not suffice; they may, indeed, conquer an adversary, but some other power must first "within my sword's length set him." Chance, it is true, might sometimes be our friend, but will never be sufficient to account for all our good fortune.

Alpha, I believe, asserts that he is not of the academy; perhaps he is not, but I am sure that he is its echo. He thinks, too, that the great talents of many of the students are misemployed, by their being confined to the directing of joiners: but I jump far beyond him; for though it is a task to which many a working man is fully equal, they are, I say, totally unfit for it; for shipwright officers they are, perhaps, more unfit; indeed, no officer who has merely to conduct the work, should have his brains much stuffed with algebraic niceties, as it is mostly found, that they take up the space which should be left for practical acquirements.

I do not blame the gentlemen of the academy for endeavouring, through the medium of any one, to make the public think well of them; but, as gentlemen, they ought not to attempt it at the expense of others. The country has certainly expected a great deal more from them than ever they have, or ever can realize; but, I think, they might give it something more than mere words, as a proof that they are not entirely useless. When they have accomplished this, they may in some measure redeem themselves from the contempt with which they are now viewed by every mechanic, and have the good will of,

Mr. Editor,

Your obedient servant,

ANOTHER WORKING SHIPWRIGHT.

March 14.

P.S. It may, Mr. Editor, seem strange, that only working shipwrights should take upon themselves to write about these chaps; but, I believe, the reason of the officers not troubling themselves, is their thinking them unworthy notice.

CHARCOAL PREVENTS RUST.

In 1817 Mr. Rosenegger, living at Birgelstein, near Salzburg, in digging up his garden, found a number of Roman antiquities, and among them urns, some of which were filled with charcoal. In them, as well as several other things, were some iron dishes or plates, parts of which were quite rusted and other parts quite sound. Osiander,* who examined these antiquities, found those plates which had been covered by the charcoal had remained sound, while those exposed to the action of the earth were rusted. This led him to examine if charcoal were a good means of preventing iron or steel instruments from rusting. He put this to the proof, and found, by a number of experiments, that charcoal was a complete protection against rust. From other experiments he recommended that books, papers, plants, seeds, &c. which are exposed to damp air, or sent abroad, should be sprinkled over or covered with powdered charcoal.† — *Verhandeling over het gebruik der Plantaardige en dierlijke kool, door, C. M. Van Dijk, &c. &c. Utrecht.*

STRUCTURE OF THE GLOBE.

By taking a very superficial view of any particular spot of the earth, it appears to be a confused mass, without order or regularity. Just as when we notice only a few of the changes of the atmosphere, they

* A celebrated German physician and chemist.

† The above little article we have taken from a "Treatise on the Use of Vegetable and Animal Charcoal, written by M. Van Dijk, of Utrecht," who has done us the honour to send us a copy of his work. We shall, probably, find an opportunity of noticing it more at length hereafter. The quotation may, we hope, be of some service, as our manufacturers may probably ere long be great exporters of machinery, which it may be of great consequence to preserve from rust.

appear the mere result of some caprice. Extended observation shows, however, that these latter are subject to general laws, though no adequate and simple expression has yet been found to designate them. It is the same with the structure of the earth. By examining it as a whole, an order and regular disposition of its materials are discovered, which lead even to inferences that different causes operating at different periods have produced its present form. To arrive at such a conclusion, we must avoid, in examining any part of the globe, all unnecessary minuteness. This, says an elegant writer, has led speculators to describe the whole as an unseemly and irregular mass. It is, indeed, surprising, that men possessed of any knowledge of the beautiful harmony which prevails in the structure of organic beings, could for a moment believe it possible that the great fabric of the globe itself—that magnificent display of omnipotence—should be destitute of all regularity in its structure, and be nothing more than a heap of ruins.

AUTOMATONS.

THREE of the most celebrated automatons on record are, the two musicians of Vaucanson, and the chess-player of M. Maelzel. The former celebrated mechanician constructed his flute-player in form after the admired statue of the fawn, by Coysevaux, which is still seen on the terrace of Versailles. The upper part had the figure of a human being, of the middle size, seated on a rock, four feet and a half high. By the movement of its lips, its fingers and tongue, the sounds of the flute were modified, and this mechanical man could play a dozen different airs. Vaucanson also constructed a tambourine-playing automaton, which, at the same time, played twenty airs on a flageolet pierced with three holes. Placed on a pedestal, and dressed as a peasant, holding in one hand his flageolet and in the other hand a stick, with which he beat his tambourine like a well-practised artist, he accompanied the music from one instrument by the music from the other, and had the appearance of an animated being regulating the pleasures of a ball. It blew louder or softer as was proper, and played with a precision and correctness, that had in them nothing of chance or uncertainty. M. Maelzel's chess-player has astonished, perhaps, every capital of Europe. It makes the best combined movement, attacks his opponent, and defends himself in the most skilful manner, and has rarely been beaten by the greatest masters. This automaton is constructed so perfectly, that when its adversary makes a wrong move it indicates it by its gestures, and will not go on with the game till the fault has been corrected. It seems, says the French author from whom we take this description, to be an animated being, and displays all the resources of intelligence to carry into effect the most profound combinations.

COBALT BLUE.

THIS fine colour, also called *Thenard's blue*, which has in many instances superseded the use of ultramarine, is a compound of alumina and oxide of cobalt. It is prepared as follows:—The ore of cobalt, consisting of this metal, iron, sulphur, arsenic, and nickel, is first reduced to powder, and roasted in a small reverberatory furnace, taking care to stir it during the calcination. The furnace ought to have a good draught, so that every part of the ore may be thoroughly calcined, and the operation is continued till the arsenic with which the metal is combined ceases to rise in vapour. It is then withdrawn from the fire, and the residue consists of the oxides of cobalt, nickel, and iron, mixed with a small quantity of arsenic and of the mineral unaltered. The residue is then slowly boiled with an excess of nitric acid

in a glass vessel. The clear liquid is poured off, and evaporated to dryness in a porcelain or platinum capsule. What remains is thrown into boiling water, the arseniate of iron is precipitated, and separated by filtration. A solution of sub-phosphate of soda is added to the solution in water, which decomposes the nitrate of cobalt, and forms a soluble nitrate of soda and an insoluble phosphate of cobalt. The latter is precipitated of a violet colour, and becomes rose-coloured by remaining under water. After being well washed and filtered, it is mixed, while yet wet, with eight times its weight of alumina in a state of jelly or paste, and great care must be taken to mingle the two ingredients perfectly and uniformly. The mixture is dried in stoves, and when it is hard and will break, it is pounded in a mortar, and afterwards exposed to a red heat in a close earthen vessel for half an hour. On withdrawing this from the fire, the fine cobalt blue is obtained. In this state it is put into a glass vessel, to preserve it. The operation always succeeds if care is taken, and if the alumina be employed as it has been precipitated from alum by an excess of ammonia, and washed with very limpid water.—*Dictionnaire Technologique.*

A SIMPLE MAGNIFIER.

A large globular bottle, made of fine white glass, is filled with pure rain or river water, in which some salts are dissolved, or with which, in winter, nitric acid is mixed, to prevent its freezing. This bottle, called a *bocal* in France, is mounted on a wooden stand, and being placed between a lamp and the workman, collects the rays of light, and converges them on any particular object. This instrument is much used by watchmakers, jewellers, and others who have fine work to perform.—*Dictionnaire Technologique.*

VACUUM BY FLAME.

(*From a Correspondent.*)

The following amusing experiment is a simple illustration of the capability which air possesses, both of rarefaction and condensation:—

Take a tumbler about half or two-thirds full of cold water; pour the water into a shallow vessel, (a dish or plate, for example,) then place a small quantity of tow loosely within the glass. The tow is now to be lighted and the glass quickly inverted in the water, when the water will be found to rise in the glass, showing that the small portion of air still remaining in the glass was, by the heat of the burning tow, sufficiently expanded to fill it, but was again condensed by the cold water, thereby producing a vacuum, into which the water, by the pressure of the atmosphere, must rise.* W.S.

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* Our Correspondent, from whom, by the bye, we shall be glad to receive further communications, does not seem to be aware, that the great expansive power of flame, which this experiment so well illustrates, is the principle on which Mr. Brown's vacuum-engine is constructed. The nice construction of his apparatus allows the cylinder where the gas is burned to be closed at the moment when the rarefaction is the greatest. Can any of our Correspondents inform us why Mr. Brown's engines are not yet coming into use? We know one *was* erected in the city, and, we understood, might be seen. On visiting it, however, we were denied access to it; and have since been informed, that it has been pulled down or removed. The illustrations of the principle of this instrument, lately published at Edinburgh, we shall give in a subsequent Number.

Answers to Correspondents in our next.

*** Communications (post paid) to be addressed to the Editor at the Publishers'.

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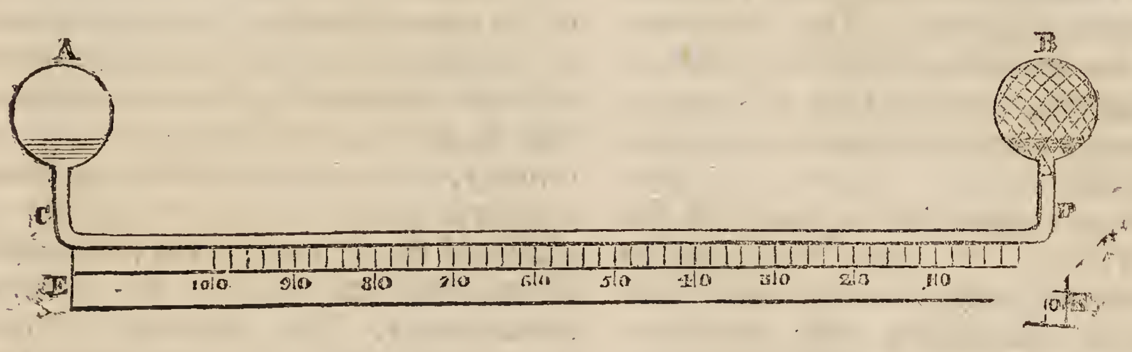

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SELF-REGISTERING HYGROMETER.

A tube, C D, such as is commonly used for constructing a self-registering thermometer, is bent upwards at C and D, and terminates in a bulb A. Into this bulb is introduced a portion of sulphuric acid, sufficient to fill the tube and a small part of the bulb; and along with the acid a small bit of glass *a*, of such a diameter as to move easily in the tube when the instrument is inverted. To the extremity D another bulb B is attached; and the air contained in both bulbs is so adjusted, that when they are at the same temperature the liquid stands at a point near the extremity D, and which is marked 0 on the attached scale E F. If the temperature of the bulb B be now increased, or, which produces the same effect, if that of A be diminished, the portion of air in the upper part of the bulb will contract, while that contained in B will expand in the same proportion, and the liquid will of course be forced from D towards C, the difference of temperature being indicated upon the scale in degrees, each of which, according to the graduation adopted by Mr. Leslie, is the thousandth part of the difference between the temperatures of freezing and boiling water. The divisions of this scale, which has been called the *millesimal*, may be thus determined:—Let the bulb A be surrounded with melting snow, while

the instrument is placed in an atmosphere of any higher temperature, say 50° of Fahrenheit, and let the point be marked at which the liquid becomes stationary. The distance between zero and this point, in the case supposed, will be 18° of Fahrenheit, or 100° of the millesimal scale, and that distance being divided into a hundred equal parts, will give the graduation required. The divisions may be extended beyond 100°, if necessary, but in this climate a greater range will seldom be required.

To prepare the instrument for observation, it only remains to cover the bulb A with silk, and moisten it, taking care that the two bulbs be as nearly as possible of the same colour. The index, or small bit of glass *a*, is then to be brought to the surface of the liquid, by depressing the extremity D, and the instrument to be exposed in a horizontal position. As the evaporation from the surface of the bulb A goes on, the air within contracts, from the depression of temperature produced by the evaporation; and the liquid is forced from D towards C by the elasticity of the air in B, carrying with it the index *a*. When the evaporation has reached its maximum, the liquid as well as the index becomes stationary; but should the process of evaporation diminish, the liquid will again move towards D, while the index is left behind, thus marking the maximum of dryness in the absence of the observer.

AN INFLAMMABLE RIVER.

We entered a small but thick wood of pine and maple, enclosed within a narrow ravine, the steep sides of which, composed of dark clay-slate, rise to the height of about 40 feet. Down this glen, whose width at its entrance may be about 60 yards, trickles a scanty streamlet, wandering from side to side, as scattered rocks or fallen trees afford or deny it passage. We had advanced on its course about 50 yards, when, close under the rocks of the right bank, we perceived a bright red flame, burning briskly on its waters. Pieces of lighted wood being applied to different adjacent spots, a space of several yards was immediately in a blaze. Being informed by our guide, that a repetition of this phenomenon might be seen higher up the glen, we scrambled on for about 100 yards, and directed in some degree by a strong smell of sulphur, applied our match to several places with the same effect. The rocky banks here approach so closely, as to leave little more than a course to the stream, whose stony channel formed our path: sulphur in several places oozed from them abundantly. We advanced about 70 yards further, when we found the glen terminate in a perpendicular rock, about 30 feet high, overgrown with moss, and encumbered with fallen pine-trees, through which the drops at this dry period of the season scarcely trickled. These fires, we were told, continue burning unceasingly unless extinguished by accident. The phenomenon was discovered by the casual rolling of some lighted embers from the top of the bank, while it was clearing for cultivation. In the intensity and duration of the flame, it probably exceeds any thing of the kind yet discovered: I could, however, find no traces of a spring on its whole course. The water on which the first fire was burning had, indeed, a stagnant appearance, and probably was so from the failure of the current; but it had no peculiar taste or smell, was of the ordinary temperature, and but a few inches deep; a few bubbles indicated the passage of the inflammable air through it: on applying a match to the adjacent parts of the dry rock, a momentary flame played along it also. These circumstances induced us to consider the bed of the streamlet as accidentally affording an outlet to the inflammable air from below, and the water as in some degree performing the part of a candle-wick, by preventing its immediate dispersion into the atmosphere.—*Hall's Travels in Canada.*

LECTURES AT THE ROYAL INSTITUTION.

COMBINATIONS OF POTASSIUM.

Lecture 30. At the beginning of this lecture Mr. Faraday described the salt called *per-chlorate of potassa*, which having no interest, we shall merely state that it is a compound of per-chloric acid, the equivalent of which has already been given, and one proportional of potassa, its equivalent number being 140. This salt is insoluble in alcohol, and difficult of solution in water.

Iodine and potassium act energetically on each other, and form iodide of potassium. This compound is made by burning potassium in the vapour of iodine, or it may be obtained by adding iodine in solution to a solution of potassa, when an *iodate of potassa* and an *iodide of potassium* are both formed, and the latter may be separated by alcohol. Iodide of potassium is a white crystallized body. When heated in an excess of oxygen, it is decomposed, and an oxide of potassa results. There is something unexplained in the action of oxygen and iodine on potassium, inasmuch as under certain circumstances, either of them will decompose the compounds of the other and potassium. They require to be added in excess; and this change of affinities, as it were, is attributed to quantities; but this explanation does not seem sufficient. The iodide of potassium is a compound of one proportional iodine, 125, and one potassium, 40, its equivalent being 165. It is used as a medicine, but with very different results, owing probably to not being always prepared correctly. By some physicians its effects have been much lauded, while others have found it to have no action whatever. It is a good test for silver and for lead. In their general action on potassium, iodine and its compounds seem to resemble chlorine and its compounds. This is, however, a statement from analogy, as only one compound of the *iodic acid*, *iodate of potassa*, which has been mentioned above, as remaining in solution when iodine and potassa are mixed, has been examined. It is a white substance, difficult of solution.

There are two compounds of hydrogen and potassium, both of which are generally formed in making potassium, by means of the gun barrel, though the experiment was not on the last day carried so far as to produce them. One is solid and the other a gas: both are highly inflammable, but are not at present regarded as of any importance, except as showing that hydrogen combines with the metals.

Potassium and nitrogen do not seem to have any action on each other; but potassa and nitric acid form together *nitrate of potassa*, which is better known under the name of *saltpetre*, or *nitre*. This salt is an abundant natural product, and is found in great quantities in India, whence it is usually imported into this country. It is there found mixed with certain soils, and is obtained by lixiviating them. What is the cause of its formation in certain districts, while in others, under the same latitude, it is never produced, has not been satisfactorily explained. Besides being thus found native, it is made in various places on the Continent, by a curious method. The rubbish is collected from old buildings, but particularly the mortar and plaster of stables and other *offices*, and the fitness of these materials to yield nitre is known by their saline taste. They are mixed with refuse animal and vegetable matters. They are heaped up in great quantities, watered with urine, and are sheltered from rain, but exposed to the action of the atmosphere; and at the end of several months, or two or three years, these heaps, on being washed, yield a considerable quantity of nitre. The French, particularly at the commencement of the revolutionary war, frequently had recourse to this mode of procuring this salt for the manufacture of gunpowder. It has been long known that refuse

animal matter, which has putrefied in contact with calcareous soils, affords nitre on being mixed with wood ashes, or carbonate of potassa; and nitre is procured by this method in some parts of Spain. Exudations on new walls frequently contain saltpetre, which probably arises from the decomposition of the animal matter in the mortar, and probably also nitrogen is taken from the atmosphere, as in the heaps for making nitre the presence of the atmosphere is indispensable. Nitre thus obtained, or as it is brought from India, is always mixed with other substances, from which it must be purified to be fit for experiments in the laboratory. It crystallizes in six-sided prisms, and is sometimes met with in very large crystals. It has a cooling and peculiar taste. It consists of one proportional nitric acid, 54, and one of potassa, 48, its equivalent number being 102, and its ultimate elements one proportional of potassium, one of nitrogen, and six of oxygen, five being in the acid and one in the alkali. The acid contains five times more oxygen than the base. Here Mr. Faraday said he might remark, as a general law, which held good in every case, as far as he recollected, except in the carbonates, that all the neutral salts contained equal proportionals. Thus the nitrate of potassa was a neutral salt; and it was found that the oxide of potassium, which constituted the base of this neutral salt, contained one proportional of oxygen; and from this general law, when we found any other neutral nitrates, we might from analogy also infer that the oxides of their bases also contained one proportional of oxygen.

Saltpetre is not altered by a heat which fuses it, except that on cooling it congeals into cakes, called *sal prunelle;* but if a greater heat be applied, oxygen is driven off; and at a still greater, both the oxygen and nitrogen are driven off, and dry potassa remains. After one portion of oxygen has been driven off, the salt still remains neutral, being, as Scheele first observed, a *nitrite of potassa.* Saltpetre is readily decomposed by charcoal at a red heat, and we find that sub-carbonate of potassa remains. This experiment was performed by throwing some charcoal and nitre into a red hot crucible, when the decomposition took place immediately. Several of the metals, in a divided state, such as iron, zinc, and copper, have the same effect. Sulphur and phosphorus thrown on hot nitre, inflame, and form phosphate and sulphate of potassa. Nitre enters largely into the combination of gunpowder, as may be seen from the following table of the quantities of the different materials in four sorts of powder:—

	Common Powder.	Shooting Powder.	Shooting Powder.	Miners' Powder.
Saltpetre,	75·0	78	76	65
Charcoal,	12·5	12	15	15
Sulphur,	12·5	10	9	20

These ingredients are perfectly mixed, and then moistened and formed into a cake. This is afterwards broken up and forced through sieves of various fineness, and then dried. The best powder for fowling-pieces is put into a barrel which turns horizontally, in which there are a number of projecting pieces of wood, and in this it gets rounded and polished by attrition. The violence of the explosion, or the strength of gunpowder, depends on the quantity of gaseous matter extricated, which is supplied by the action of the carbon and of the sulphur on the nitre. The principal use of the sulphur is to make the whole mass inflame, and thus produce the greatest possible quantity of gaseous matter. The greater the quantity of saltpetre in proportion, the less the strength or quickness of the powder, but the greater the certainty that it will all inflame. For this reason, the best shooting powder, which is required to explode rapidly, contains the most charcoal and nitre, while the miners' powder, which is used for blasting, the certainty of its operation being of more importance than its swiftness, has a greater quan-

tity of saltpetre. Pure charcoal is found not to be so good as charcoal which is made from light woods and not fully burned, so as still to contain a small quantity of hydrogen. The gaseous results obtained by exploding gunpowder are found to be carbonic oxide, carbonic acid, nitrogen, and sulphurous acid; the solid matters which remain consist of subcarbonate, sulphate, and sulphuret of potassa. In France, at present, a more careful method is adopted in making gunpowder, the proportions of the materials are accurately measured, and a hard grained good powder is made.

Sulphur and potassium act on each other, giving out much light and heat, and they combine in the proportion of 1 sulphur, 16, 1 potassium, 40, forming the *sulphuret of potassium*=56, which when acted on by water, produces sulphuretted hydrogen. Sulphur also unites in a second dose with potassium, and forms a *bisulphuret*, the quantity of sulphur being exactly double, or 32, and the equivalent of the compound 72.

Sulphur and potassa also combine when fused together, and form a sulphuret of potassa, formerly called liver of sulphur. It is very soluble in water, and forms a yellow hydrosulphuret of potassa. In the action of water and the sulphuret on each other there is something which is unexplained, and which, Mr. Faraday said, requires to be cleared up. There is also a bisulphuret of potassa, which is obtained by heating carbonate of potassa and sulphur.

The acid compounds of sulphur also combine with potassa, and form an important class of salts. The *sulphate* of potassa is the result of several chemical operations in various manufactures. It is a compound of 1 proportional acid, 40, and 1 proportional alkali, 48, its equivalent being 88. It is a neutral salt; and as the sulphuric acid contains three proportionals of oxygen and the alkali one, we may infer, that all the other neutral sulphates will contain, like this, three times as much oxygen in the acid as in the alkali or the oxide. This salt is not altered by a red heat, though it melts; it is the *potassæ sulphas* of the London Pharmacopœia. The *bisulphate of potassa*, or supersulphate, is formed by boiling sulphate of potassa with sulphuric acid. The salt is used for cleansing coins and metals of several descriptions, as well as by jewellers, who employ it to clean plate, and for various other similar purposes.

The action of phosphorus and potassium, and of phosphoric acid and potassa, being much the same as the action of sulphur and sulphuric acid on the metal, as was remarked by Mr. Faraday, and there being nothing interesting or useful in these compounds, we shall not enter further into the matter, than to remark, that there are also phosphurets of potassium and phosphates of potassa.

Mr. Faraday said nothing of the combinations of potassium and carbon, whence it may be inferred, that no combination of these two substances is known. *Potassa* and *carbonic acid*, however, do enter into combination, and form the carbonate and bicarbonate of potassa, two salts which have been long known and extensively used. Carbonate of potassa is of great importance in many arts, and is known under the different names of wood ashes, pot ashes, and pearl-ash. In the London Pharmacopœia it is called the subcarbonate of potassa. It is obtained from wood ashes. Whenever wood is burnt the residuum contains a considerable quantity of the carbonate of potassa. In countries where there is an abundance of wood, they burn it to get rid of it, and derive a profit from the ashes: thus, a great portion of the carbonate of potassa used in this country is brought from America, under the name of pearl-ash, which consists of these ashes, having a further quantity of their impurities burnt off. This salt may be obtained directly by adding carbonic acid to a solution

of potassa, evaporating to dryness, and exposing the dry residuum to a red heat; or it may be obtained by burning *tartar*, whence it has been called *salt of tartar*. It possesses alkaline properties, and makes vegetable blues green. It is a compound of 1 proportional acid, 22, and 1 proportional alkali, 48, and its equivalent is 70. The farther consideration of this subject was postponed to a future lecture.

PREMIUMS OFFERED BY THE HAARLEM SOCIETY.

We continue our translation of those questions for the solution of which premiums are offered. The answers must be sent before the first of January 1826.

4th. What insects are the most injurious to fresh trees? In what does the disease consist, which these insects cause in the plants? What are the best means, ascertained by experiment, and deduced from our knowledge of the habits of these insects, to prevent the mischief they cause to trees, or to entirely clear the latter from them.

5th. As it has been lately asserted and is believed, that several proximate principles of plants or products of the vegetable kingdom have been discovered, it is asked, what have repeated experiments really proved on this point? By what means are these proximate elements procured in the easiest and most certain manner? As they are also used at present in medicine, it is further inquired, of what utility are these discoveries to the art of healing; and what further advantages may be anticipated from them?

6th. What progress has our knowledge made of that species of fermentation which produces acetic acid? Can we explain, by any thing we know, the different methods practised to prepare acetic acid of different kinds, including within these methods the one lately introduced into Germany, in *which the vinegar is diluted with an equal quantity of water, certain substances are added*, and then *a double quantity of vinegar is obtained of the same strength?* What rules can be drawn from this knowledge for the improvement of vinegar manufactories?

QUERY.

The best and most economical mode of making starch from potatoes?

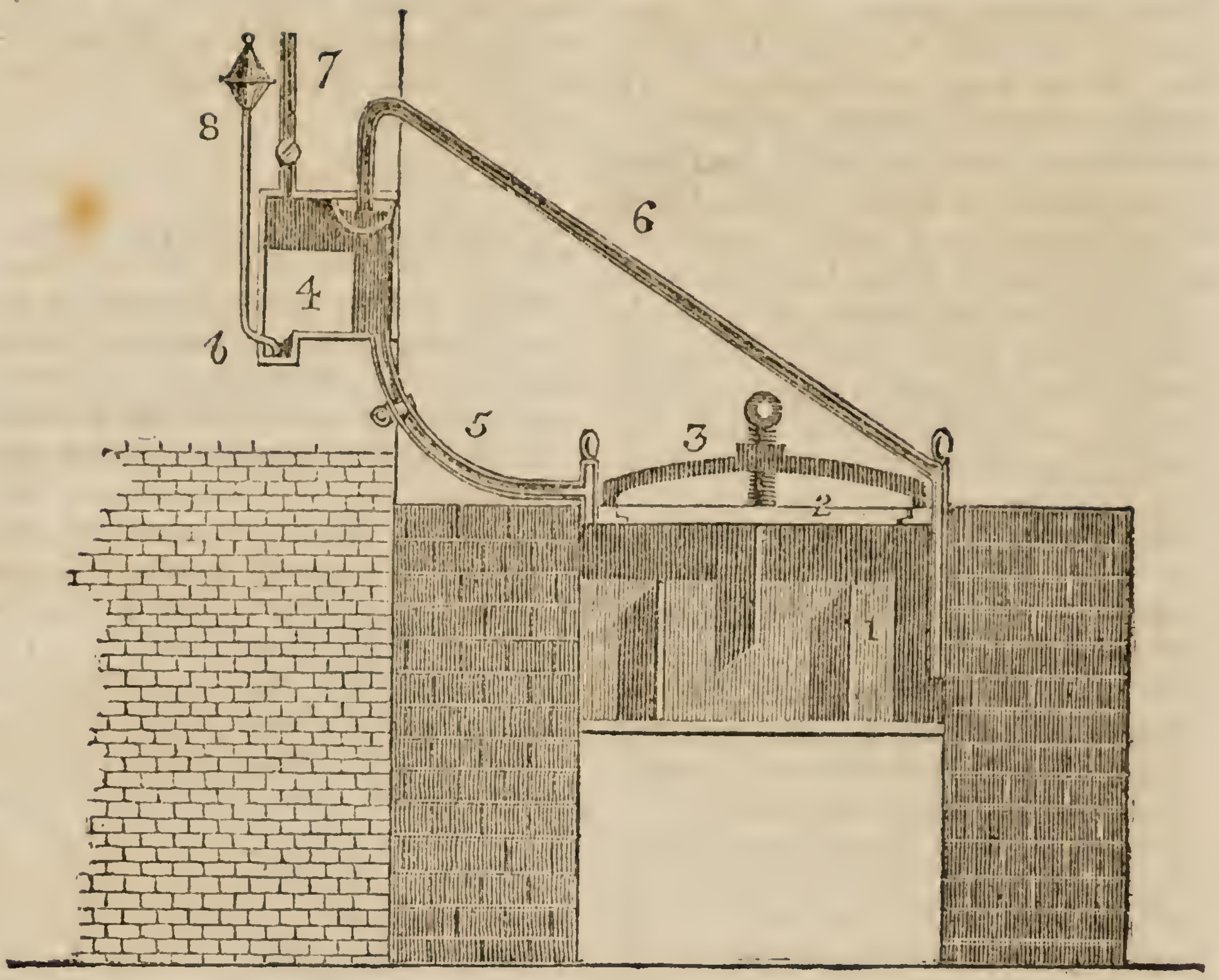
BREATHING IN SMOKE.

On Friday, March 25th, we witnessed, at the building belonging to the Mechanics' Institution, a somewhat curious experiment.—Mr. J. Roberts, who is described as a miner, went into a close wooden building entirely filled with smoke, and remained there for 36 minutes. The building had been prepared for the purpose, and was about 16 feet square. A fire of wood shavings and damp straw was made in the middle of it, and on this was thrown about two pounds of sulphur. Before he entered it the room was entirely full of smoke from these materials, to within one or two feet of the ground, and the thermometer stood nearly at 70°. Even at this period one or two persons, and among them was Sir Robert Wilson, suffered great uneasiness from putting their heads into the building for only a very short time. On Mr. Roberts going in the door was closed, while the fire continued burning, so that the whole place was filled with a dense sulphurous smoke, which was disagreeable even to those outside, as it forced its way through the crannies and seams of the building. A thermometer and a lighted candle were placed inside the building, so that they could be seen through a window. For 25 minutes after Mr. Roberts went in the candle continued to burn, and then it went out. The temperature rose to 103°, and still Mr. R. remained in the heated and stifling room. Altogether he remained in the place 36 minutes, and when he came out appeared to suffer no other inconvenience, and said he felt none, but from the heat. It is probable, that under ordinary circumstances no man could have lived in such an atmosphere for one minute; and some firemen present declared they would not attempt it for a moment. Mr. R. not only stood on the floor, but he ascended more than once to the top of the room, and continued on his legs and moving about the whole time. Here then we have an example of an individual living

in sulphurous smoke. Mr. R. accomplished this by what he calls his HOOD and MOUTH-PIECE. It consists of a covering of leather, which goes over the head, and ties close about the neck. In the front of it there is a large piece of glass to allow him to see, and attached to the mouth is a flexible leather tube, about four feet long. The end of the tube expands into a sort of funnel, about six inches in diameter, and this funnel is filled with sponge covered with a woollen cloth, which admits of its being moistened with or soaked in water, or any other liquid. It is by the aid of this apparatus that Mr. Roberts resisted the action of the smoke, and was enabled to get, from near the ground, a sufficiency of good air to breathe. We hardly understand the principle of the apparatus; but much of its utility seems to depend on the soaked sponge, which permits the passage of atmospheric air, but detains many acid and other noxious gases. We do not exactly see how the product of respiration is got rid of; nor can we find any adequate reason for the man not being suffocated by the carbonic acid he himself forms. The apparatus may enable persons to pass into apartments filled with smoke, to remove valuable objects, or to save the life of some helpless and infirm person, when it is known that there is no fire beneath, and no pieces of mortar, and no melting lead falling from above; but, as the firemen present observed, could not be of much use on ordinary occasions. Mr. Roberts was quite sure of his footing, and was under no apprehension of any thing knocking him on the head. In cases of fire, however, the chance of the floor or staircase giving way, or of the roof or ceiling falling in, are greater impediments to exertion than smoke; and in enabling a fireman to avoid or overcome these, the hood and mouth-piece would rather be an injury than a benefit. Mr. Roberts' title to the invention is, we understand, disputed; but he certainly has the merit of applying it under circumstances sufficiently disagreeable, if not dangerous, to deter many persons.

CHARCOAL AS AN ANTISEPTIC.

It has long passed current in the scientific world, and has been repeated in every chemical book we have ever seen, that M. Lowitz was the first person to observe the antiseptic effects of charcoal. M. Van Dijk, in the pamphlet we quoted last week, begins his labours by showing, that this property of charcoal was known to the Egyptians, Greeks, and Romans. The former strewed charcoal over the corpse or mummy they wished to preserve; and both the Greeks and Romans employed charcoal to counteract the unhealthy effects of marshy ground. Long before M. Lowitz's time, also, charcoal was used both in Holland and Germany to preserve meat in summer, and to cure the rot in sheep. The quotations from authors, given by M. Van Dijk, seem to prove fully, that the antiseptic qualities of charcoal, though, like many other valuable pieces of practical information, not recorded in every book written on the subject, were well known for many years before M. Lowitz published his paper on the subject in Crell's Annals. We do not believe, however, that we should have noticed this subject, were it not that men of letters, and scientific men who can write, are too generally disposed to take credit to themselves for the discoveries which they only record, and to impute ignorance to all who are not book-learned. In fact, though we are by no means advocates for even book ignorance, good sound, practical knowledge is frequently met with in men who do not know the alphabet.



IMPROVED FAMILY OIL GAS APPARATUS.

Fig. 1 is a retort (made in the form of a back for a kitchen range or other fire-places), intersected with perpendicular partitions, so as to create a greater extent of surface for the gas to pass over, which will greatly promote the purification of it.

Fig. 2 is a lid to allow the cleaning of the retort, secured by a bar across the top, fig. 3.

Fig. 4, a close cistern containing oil.

Fig. 5, a pipe leading from the cistern to the retort, having a regulating cock.

Fig. 6, a pipe connecting the opposite end of the retort with the top of the cistern, and furnished inside with a small cup full of oil, about four inches deep, into which the end of the pipe is inserted, to prevent the return of the gas while the retort is cleaning.

Fig. 7, a pipe to convey the gas away when formed.

Fig. 8, another pipe, with a funnel to supply oil from time to time, having the lower end inserted in the sunk end of the cistern *b*, by which means the gas will be prevented from escaping, should the cistern by any accident be left too empty.

This apparatus will not require an extra fire. Should any oil escape in the form of steam, it will be condensed, and return to the retort again to undergo decomposition. By the recesses in the cistern it will be impossible for the gas to escape into the room without having first passed to the gasometer, which may stand in any convenient place.

It is calculated that one gallon of whale oil will make 100 cubic feet of gas, which, at 2*s*. per gallon, and allowing 1*s*. for expenses and interest, will make 3*s*. per 100 feet, or about 2¼*d*. for a light, equal to that obtained from 1 lb. of candles.

To increase the effect of the retort, it may be filled with coke or old pieces of brick.—*Mechanics' Magazine.*

DICTIONARY OF CHEMISTRY.

HYDRIODATES. Salts consisting of hydriodic acid and bases.

HYDRIODIC ACID is a compound, consisting of equal volumes of hydrogen and vapour of iodine; it is of course a modern discovery, as iodine itself has not been many years known. It is of no importance, though it has been combined with several of the bases, forming, for example, the hydriodate of ammonia, baryta, &c.

HYDRIODIDE OF CARBON. A compound of carburetted hydrogen and iodine.

HYDROBORACIC ACID. Boracic acid and water, as it is obtained by dissolving borax in hot water, and adding sulphuric acid.

HYDROCARBURET, *carburetted hydrogen, olefiant gas.*

HYDROCHLORIC ACID, *muriatic acid gas.* The first name is formed on the principles of modern nomenclature.

HYDROCHLORATES *muriates.*

HYDROCHLORIDE OF CARBON, *chloric ether.* A compound of chlorine and carburetted hydrogen.

HYDROCYANATES, *prussiates, ferroprussiates.* Compounds of hydrocyanic acid and bases.

HYDROCYANATE OF IRON, *ferrocyanate of iron, prussian blue.*

HYDROCYANATE OF POTASSA, *ferrocyanate of potassa.* The substance used as a test for most of the metals.

HYDROCYANIC ACID, *prussic acid.*

HYDROFLUATES. Compounds of fluoric acid with bases; some authors calling *fluoric acid*

HYDROFLUORIC ACID. The hydrofluates known are of no importance.

HYDROGEN GAS, *inflammable air.* The lightest species of ponderable matter. It was first discovered by Mr. Cavendish, in 1766; but for an account of it we must refer to other parts of The Chemist. We have only to remark in this place, that in combination with various substances, their names form the adjective part of the compound term, and such of them as have any synonymes, or are of any interest, deserve a place here.

HYDROGEN, ARSENURETTED. A compound of arsenic and hydrogen.

———, BICARBURETTED, *carburetted hydrogen.*

———, BIPHOSPHURETTED, *phosphuretted hydrogen, hydroguret of phosphorus.*

———, POTASSURETTED.—One of the products of the method of obtaining potassium by the gun-barrel.

———, SELENURETTED. A compound of selenium and hydrogen, which is very irritating to the nostrils.

———, SULPHURETTED, *hydrothionic acid.* When combined with water it is called *hydrosulphuric acid.*

———, SUPERSULPHURETTED. The existence of this compound, though described in many books, is doubtful.

———, TELLURETTED. A compound of tellurium and hydrogen.

HYDROGURET OF CARBON, *carburetted hydrogen.* It consists of 1 proportional carbon and 1 proportional hydrogen.

HYDROGURETS, *hydrurets.* Solid compounds of hydrogen with other substances.

HYDROMETER. An instrument for determining the specific gravity and strength of various liquids, such as alcohol, corrosive acids, &c. &c.

HYDRONITRIC ACID, *nitric acid and water.*

HYDRO-OXIDES, *hydrates, oxides and water.*

HYDROPHANE, *oculus mundi.* A species of opal, which becomes transparent on being immersed in water. Care must be taken to use pure water, and to withdraw the stone the instant it has acquired its full transparence.

METEOROLOGY OF 1824.

BAROMETER.	Inches.
Highest observation, Jan. 16, wind N.W.	30.780
Lowest ditto, Nov. 23, wind S.E.	28.210
Range of the mercury	2.570
Mean pressure	29.770

SIX'S THERMOMETER.	
Highest point, July 14, wind S.E.	86.000
Lowest ditto, March 3, wind N.	22.000
Range of the mercury	64
Mean temperature	47.683

WINDS.	Days.
North	58
North East	52
East	13
South East	19
South	38
South West	70
West	59
North West	31
Variable	26

There were 117 days' rain, and there fell 36.24 inches. There were also 15 days' snow, and 5 of hail. The mean temperature of the year corresponds nearly with that of 1819, and the quantity of rain being six inches less than fell in 1823, about equals the quantity which fell in 1822. Upwards of 20 inches of the whole 36.24 fell after Sept. 1, and two-thirds of this quantity fell by night, frequently attended with gales of wind These results are taken from a table kept by Mr. Stockton, at New Malton, Yorkshire.

THE CLIMATE OF THE ANTEDILUVIAN WORLD.

(*By Sir Alexander Crichton, Knight, F. R. S. Abridged from the Annals of Philosophy.*)

We noticed a few Numbers ago the absurd and nonsensical attempt of a Frenchman of high reputation, to subject to calculation the laws by which the world is gradually growing colder. The utility of all such attempts, and the knowledge they convey to us, never exceeds, by the smallest possible quantity, the definitions the author lays down at the beginning. Within them, all his calculations are strictly circumscribed; and we are, therefore, just as wise at the conclusion as at the commencement. The learned men who thus employ themselves have not, in fact, got beyond the first elements of knowledge; and are quite ignorant that mathematical demonstration, like all other truth, ultimately rests on the evidence of our senses. What they cannot teach us we can never learn from it; and, therefore, all the efforts to find out by it *what was* before our species existed, do not deserve one moment's attention. This is not the case, however, with certain facts, which may now be observed, and which being quite incompatible with other facts at present existing, or at least never now coincident with them, warrant as an inference, that at some remote period the *climate* of every part of our globe was different from what it now is. Thus, the skeletons of various animals and plants, which are now found only in tropical climates, and pine and perish if removed out of those climates, are continually met with amongst the soil in caves and in mines, in the very coldest parts of our present globe. Either the nature of these animals and plants has undergone a total change, or the climate of the whole world has altered. In such a statement there is something tangible, something which the mind can conceive, and of the truth of which evidence may be laid before it. To do this is the object of the paper, the title of which we have just copied. But before we proceed to abridge it, we must remind the reader that we lately published a chronological table, showing, that for upwards of 1400 years no sensible alteration has taken place in the climate of Europe. No theory which is in opposition to such a series of observations is worth one straw. Though it should therefore be admitted, that at some former period the general climate of the world was different from what it now is, there is

no reason to believe that it continually grows worse. There is, on the contrary, every reason to believe, both from astronomical theories, and such observations as those we have already adverted to, that the world does not, like an individual, deteriorate as it grows old; it is rather, like our race, improved by the labours of successive generations. Former revolutions in the globe, says a writer of eminence on Geology, are of a different nature from the effects now produced on the surface of the earth; and therefore the speculations with regard to them are to be considered more interesting on account of the facts they bring to light, than from any intrinsic merit they themselves possess.

The first circumstance which Sir Alexander points out is, that geology,—or the manner in which the substances forming the crust of our earth is disposed,—proves that the whole surface of the earth was of one uniform temperature, and that a high one, compared to the present temperature of the globe. There have been found in various caves in Yorkshire, in Germany, in France, among the ice in Siberia, the remains, both fossil and other, of elephants, hyenas, and other animals, which now only exist in warm climates. There is, however, a possibility, that the locomotive faculties of these animals may have carried them from a warm to a colder climate; and, therefore, this evidence, however improbable the supposition of their migrating so far, is not much to be relied on. Among the limestone rocks also of northern climates shells are now found, bearing a close analogy with those which are the abodes of fish living in the Indian and Pacific Oceans. Such shells and such fish have also been found in the Mediterranean; and this evidence, whatever weight may be due to it, is not considered conclusive.

Although they, therefore, says Sir Alexander, are to be rejected as positive proofs of a very elevated temperature in northern latitudes at the time that the inhabitants of these shells were alive, yet they may be admitted as concomitant proofs of a great equality of temperature, and that a warm one, over a great portion of our earth, such as cannot be explained by solar influence; for when we reflect that the analogous species of several of these (such as the *nautilus pompilius* found at Grignon and Courtagnon) are only found in very warm climates, and that a fossil shell, analogous to the living *trochus agglutinans*, which inhabits the seas of South America, has also been found as far north as Hordwell and Barton, in Great Britain; at Grignon, in France, and also in the contemporaneous deposits of many other places in Europe, it follows as a most probable supposition, that the temperature of those northern latitudes was many degrees warmer formerly than it is at present. Whoever reflects that among the immense number of fossil shells many are remarkable for their extreme thinness, delicacy, and minuteness of parts, none of which have been injured, but, on the contrary, are most perfectly preserved, will find it impossible to admit the notion of their having been brought from warmer and distant regions to the places where they are found by some great and sweeping catastrophe. Many of them could not have been carried even a short distance by an agitated ocean, or the retreat of waters, without suffering attrition and fracture.

Not only, however, do we find in the upper strata of the mineral crust the bones and skeletons of the large terrestrial quadrupeds of warm climates, and of shells analogous to those of the South Sea, but, on descending lower into the bowels of the earth, we find a peculiar and interesting series of plants. In the midst of beds of coal, the very lowest which have yet been reached, fossil plants of the fern tribe, or plants resembling palms or guccas, are found in great abundance. The perfect state in which they exist is calculated to do away all idea of their having

been brought from distant regions by powerful currents, or by the retreat of waters. Their leaves, many of which are of the most slender and delicate structure, are found fully expanded, and in their natural position in regard to the rest of the plant, and laid out, as it were, with as much care as if in the *hortus siccus* of a botanist. The minutest parts do not appear to have suffered the smallest attrition or injury.

It is quite impossible to reconcile the many facts of this kind with the effects of any sudden or violent change of place, or with a long journey, however gentle.—Compare the calm deposit of shells, and the appearances of the still calmer death of the antediluvian vegetable world, with the boulder stones, the gravel, and the disjointed, dispersed, and fractured osteology of the diluvian deposits, and it will be allowed that there is not the slighest analogy between these classes of events.

But it is acknowledged that the living plants which have the nearest resemblance to these antediluvians, are tropical plants which have not yet been found beyond the 39th or 40th degree of north latitude. Every coal country in every part of the world, which has hitherto been examined, abounds in the fossil remains of similar vegetables; and it may be remarked, in the very outset of this essay, that as certain plants, perhaps I might say all plants, belong to specific temperatures, or at least depend for their life and health on heat much more than on soil, and as most of the remains of plants belonging to the coal formation appear from their integrity to have been buried where they grew, we are forced to admit the conclusion, that wherever they are found there must have been a warm temperature.

The laws of vegetable life, as relating to temperature, are positive, and therefore, when connected with the individuals of the antediluvian vegetables, they throw the greatest and surest light on the subject of its climate.

Among the remains of the plants which belong to the coal formation, we scarcely find any variety, let the latitude, longitude, or elevation be what they may; but supposing a few species were discovered in any one district which were not common to all, it would only prove the influence of a local cause, the rest being all alike. Almost all genera and species of plants belonging to that early period of the world, appear to have been extremely limited; they are remarkable for their similarity under whatever parallels they are found.

Every plant in the present world, independently of its natural dwelling-place, has, as it were, a central spot in which it flourishes best; and considering this spot as the centre of a circle, or rather as a zone, the plant degenerates in proportion as it approaches the limits of this district. This kind of zone seems to depend chiefly on the elevation above the sea, and consequently on temperature. Some plants descend from the mountains towards the plains, others creep upwards to a limited height, and then disappear. But in the ancient world, any difference which might be supposed to have existed in regard to the elevation of those places which are called coal basins, did not produce a variety in the plants of that age, which is another proof that a cause of heat was then acting on the earth, which did not resemble the action of the sun in our days.

It has been remarked, that the fossil remains of the vegetable world which are found connected with the coal formation, are all of them similar to plants requiring great heat and moisture, and many facts in geology induce us to believe, that at those early periods of our earth, there was less dry land than at present.

Except, therefore, we admit that vegetable life was under totally different laws from what it is at present, we must allow that a much greater uniformity of tem-

perature existed in the early ages of the world over the whole globe, than is the case in our days. There is, in fact, no way of accounting for the very little variety which exists in the antediluvian plants of the period I am alluding to, and of their great similarity in every part of the world, but on the principle of great extent and uniformity of a high temperature, however difficult it may be to reconcile this to our notions of the obliquity of the earth and solar influence.

Whatever the temperature may have been which was necessary to support the life of the vegetable kingdom of that early period of the earth's existence, it must be admitted that that temperature was the same towards the polar regions as in the tropical ones, for in both, the genera and species of antediluvian plants are similar, and the shells and corals of the mountain limestone in the most distant parts of the contemporaneous strata also correspond with each other. In the collection of the Geological Society of London, there is a specimen of a very remarkable variety of felicites from the coal formation of Australia, about the 29° south of the equator, and another exactly resembling it from the coal formation of Newfoundland in the 49° north of the equator. The fossil shells of Van Dieman's Land correspond with those of Derbyshire. Upon descending below the coal formation, proofs of the equality of a high temperature over the whole earth are multiplied; for upon examining the mountain, and more especially the transition limestone, which comes more immediately in contact with the primitive rocks, we find madrepores, encrinites, corallites, and all the varied habitation of sea polyps, the existing *analogues* of which are always found in tropical climates. It is in the Pacific Ocean, and chiefly in the Red Sea, the Persian Gulph, and the Carribean Sea, that the greatest coral rocks of modern times are found. But in the ancient world, not only pentacrinites, madrepores, corallites, and encrinites, are found in the transition and mountain limestone of the coldest regions, but also whole genera of testacea, the living resemblances to which, with a few exceptions, are only to be met with at present in warm climates.

It is well known that the sensible heat of our atmosphere varies with the latitude, longitude, and the elevation of the place where the observation is made, and that the temperature on the surface of the earth corresponds in a great degree with that of the atmosphere; but the ancient temperature of the earth appears to have been equal and permanent in every spot, at least for a very long period.

(*To be continued.*)

PALE TIN PLATE LACQUER.

Strongest alcohol, 4 oz.
Powdered turmeric, 2 drachms.
Hay saffron, 1 scruple.
Dragon's blood, in powder, 2 scruples.
Red saunders, ½ scruple.

Infuse this mixture in the cold for 48 hours, pour off the clear, and strain the rest, then add

Powdered Shellac, ½ oz.
Sandrach, 1 drachm.
Mastic, 1 drachm.
Canada balsam, 1 drm.

Dissolve this in the cold by frequent agitation, laying the bottle on its side to present a greater surface to the alcohol; when dissolved, add 40 drops of spirits of turpentine.

DEEP GOLD LACQUER.

Strongest alcohol, 4 oz.
Spanish annotto, 8 grains.
Powdered turmeric, 2 drachms.
Red saunders, 12 grains.

Infuse and add shellac, &c. as to the pale tin lacquer, and, when dissolved, add 30 drops of spirits of turpentine.

N. B. Lacquer should always stand till it is quite fine before it is used.

SPRINGING OF GLASS IN A VACUUM.

Mr. Professor Gustavus Bischof, at Bonn, has lately observed rather a curious effect produced in some species of glass, when left in the vacuum of an air-pump. He placed a glass with sulphuric acid for the purpose of drying some animal substance, contained in another glass tube, within the receiver of an air-pump. He was then prevented by illness from attending to his laboratory for upwards of a fortnight, so that the glass with the sulphuric acid remained nearly three weeks in the partial vacuum. At the end of that time it was found to be sprung, or broken, on both the inside and the outside, in all directions, so that a vast number of little glass leaves or flakes were formed, resembling the cracking and separation of varnish or enamel, when exposed to heat. The breaks and little risings were visible by the naked eye, but were much more perceptible when the microscope was used. At a little distance the glass had the appearance of ground glass. It was plain that a thin layer or coat, both on the inside and the outside of the glass, had broken, and might be peeled off. That the sulphuric acid had no effect in producing this change appeared to be proved by the circumstance, that it was most remarkable in the part of the glass above where it reached; and that it was something peculiar to that particular glass, or glass of the same species, was evident from the circumstance of the glass tube containing the animal substance not being altered. At one part of the glass a great number of small glass threads had formed and separated; they were as thick as a horse-hair, but broader than they were thick. The places whence they separated had the appearance of furrows. The Professor then endeavours to explain the cause of this change; but supposing our readers may like to exercise their ingenuity in this way, we shall defer till afterwards giving them his explanation.

COVERING FOR THATCH.

In 1824 Baron Puymaurin showed to the Academy of Sciences at Toulouse, some experiments on a covering for thatch. It consisted of clay, sand, horse-dung, and lime, well mixed together, and made into mortar. It was applied with trowels, and made about four lines in thickness above the straw. As it dries it very often breaks and cracks, and these cracks are to be filled up with a mixture of the same ingredients, but in a more liquid state. It was found by several trials, that this covering rendered the straw thatch completely incombustible.

THE WIND BEGINS TO LEEWARD.

In 1740 Dr. Franklin noticed the commencement of a storm, blowing from the north-east, at 7 o'clock in the evening. The same storm was not, however, felt at Boston, situated to the north-east of Philadelphia, till 11 o'clock. By comparing together the different times at which the storm became sensible at different places, it was ascertained that the wind from the north-east began, in fact, to leeward. Dr. Franklin concluded that this storm was produced by some great rarefaction of the air in the gulf of Mexico; and he illustrated his idea of its progress, by supposing a body of water suddenly allowed to escape at one point: the water next the point would run off first, and then the water nearest it; and that which would be last in motion would be the water farthest from the exit. It was found that this storm began an hour later throughout the United States of America, for every 98 miles. A similar storm was accurately observed on the coast of America in 1802. It began at Charlestown at 2 o'clock, P. M., it was felt at Washington at five, at New York, which is still further to the north than Washington, at ten o'clock in the evening, and did not reach Albany till the beginning of the following day.

TO GILD SILVER WITHOUT HEAT.

Procure a concentrated solution of muriate gold, and into it dip pieces of linen rag; suffer them to dry, and then set them on fire. By this means the gold they have taken up is reduced to the metallic state, and is mixed with the charcoal of the rags, in the form of powder. Take a soft round cork, moisten it with water, and dip it in the powder, a small quantity of which will adhere to it. The surface of the silver, which should be perfectly clean, is then to be rubbed strongly with the cork, and it will be covered with a very thin coating of gold. It may be made brilliant by burnishing.

DISTORTED LIKENESSES.

To the Editor of The Chemist.

Mr. Editor,—Being a reader of your Work, I have remarked, that you sometimes give a corner to experiments that are amusing, though not strictly chemical; and I therefore suppose the following may not be unacceptable to your readers. I have never seen it practised in England; but perhaps it may be so common here, that I, who have been for some time absent from my native country, may suppose, unjustly, that I am introducing a novelty. I saw it practised, however, in France, when I lately made a visit to that country. It requires some skill to perform it well. A rough profile likeness on paper of some person was pierced in the outline and on the principal points, with a pin, a great number of times; this was then placed in a darkened room between a solitary candle and the wall. The rays passing through the different holes marked the desired figure on the wall, in points which were united by means of chalk or pencil, and the consequence was a likeness on the wall of the party for whom the profile was made. If the eye were placed in the point occupied by the candle the likeness was perfectly regular; if the spectator saw it from any other spot his laughter was excited by a grotesque resemblance. The ludicrous distortion was increased or diminished, by varying the position of the candle and of the likeness with regard to the surface on which the image was thrown. In doing this well the artist shows his skill. In general, the object, I observed, was to make the image so much deformed, that unless the eye were in the true point of view it was hardly possible to tell who the likeness was intended for; and after it was drawn, much ingenuity was exercised in guessing at this, by those who were not present when it was done, and in finding out the point of view whence it ought to be seen. Hoping you may find this imperfect description worthy of your insertion,

I remain, Sir,

Your most obedient servant,

Limehouse, March 20. Indicus.

MAGNESIAN BREAD.

It is rather curious to hear the bakers condemned for using alum, and the chemists praised for recommending the use of magnesia in bread. The reason is, that the chemists do it from scientific motives, and with a knowledge of its consequences, while the bakers do it out of greed, and are both careless and ignorant of the consequences of their proceedings. In 1817, Mr. Edmund Davy proposed to mix carbonate of magnesia with flour, in the proportion of from 20 to 40 grains for a pound of flour. The magnesia should be well mixed with the flour before making the dough, and then it is found that the dough rises well, is light and spongy, of a good colour and taste. If the flour is very bad, 40 grains should be used; if not very bad, 20 are sufficient. The following experiments show the result of this recommendation:—Some very bad seconds flour was taken, and five small loaves made of it, each containing one pound of flour, 100

grains of salt, and a spoonful of good yeast. The dough was mixed with water at the temperature of 100°, and placed before the fire to ferment for two hours at the temperature of 70 .

The first loaf contained nothing else; to the second 10 grains, to the third twenty grains, to the fourth 30, and to the fifth 40 grains of carbonate of magnesia were added. After the loaves had all been baked, it was found that the *first* had fallen in the oven, was soft, doughy, and adhered to the knife; the *second* had risen a little, and was on the whole somewhat better; the *third* was somewhat lighter, and porous, and on the whole considerably better; the *fourth*, containing 30 grains of magnesia, was still better; and the *fifth*, with 40 grains, was uniformly light, well tasted, and superior to all the others. The use of this substance is not in any way deleterious; it may be given to children; and Mr. E. Davy used exclusively bread made with carbonate of magnesia, in the above proportions, for five weeks without suffering the least inconvenience.

A FULMINATING POWDER

May be made by mixing three parts of nitre, two of dry subcarbonate of potassa, and one of sulphur. If a small quantity of this compound be heated on a metallic plate, it blackens, fuses, and explodes with great violence, owing to the rapid action of the sulphur on the nitre.

MORE MINERAL CAMELEONS.

Dissolve some oxide of nickel in caustic ammonia; the solution is a rich blue; by exposure to the air it changes to a purple, and afterwards to a violet. If an acid be added, it becomes green; pour ammonia into this green solution, and the original blue is restored.

TO GILD SILK.

Dip a piece of white silk in an aqueous solution of nitro-muriate of gold, and while wet expose it to the action of sulphurous acid gas, which may be done by burning a little brimstone and confining the vapour: in a few seconds the whole piece will be covered with a coat of gold, which remains permanent.

THE MINERAL RAINBOW.

An aqueous solution of nitro muriate of gold, says Mr. Fulhame, was poured into a china cup containing some phosphorized ether; instantly the gold began to assume its metallic splendour, attended with a variety of colours, as purple, blue, and red, the beauty of which cannot be described, but which depends on the different degrees of reduction.

TO CORRESPONDENTS.

We have received a valuable hint from an anonymous Correspondent. The subject he alludes to it was our intention to describe; and we shall, in our next, give rather a detailed account of the mode of making spirit from potatoes.

We do not understand the letter of "An Old Friend," and think he has not understood us. We have described, in No. 50, the best and only method we have heard of for obtaining quinina.

Communications received from "J.V.," "A Subscriber," "Deflagrator," and "E.W."

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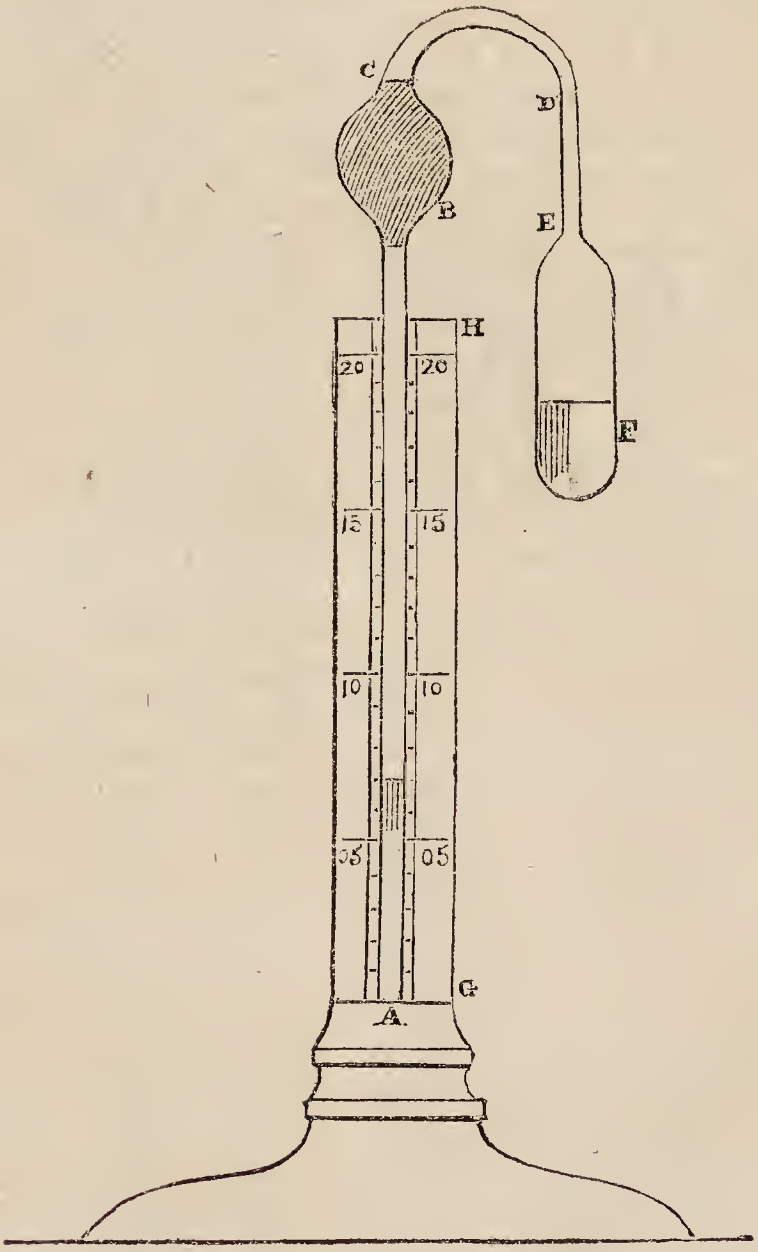

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ANDERSON'S ATMOMETER.

In all meteorological observations an instrument for measuring evaporation is of some consequence. Several means have been employed for this purpose, but the instrument, of which the following is a description, seems the best hitherto invented:—

It consists of a bent glass tube, A B C D E F, of sufficient width to admit of a liquid moving easily from one part to another, and swelling out into the bulbs BC and EF. Into this tube at A is introduced a quantity of alcohol, which, after being conveyed into the bulb or wider tube EF, is thrown into a state of ebullition, and while the steam is issuing from A, the tube is there hermetically sealed, so that the air is completely expelled from the space ABCDE. The bulb BC is then covered with moistened silk or paper, and the instrument freely exposed. In consequence of the pressure of the air being removed from the surface of the alcohol in the bulb EF, a portion of that liquid passes into vapour, and occupies the empty part of the tube. Were the whole of the instrument at the same temperature, this process indeed would quickly be stopped by the pressure of the vapour itself on the surface of the alcohol; but as the bulb BC has its temperature reduced by the external evaporation from the moistened silk or paper, the vapour which rises from EF is there condensed, and runs down in a liquid state into the tube AB. This distillation goes on more or less rapidly, according to the degree of cold induced upon the bulb BC; that is, in proportion to the external evaporation; and, consequently, the quantity of liquid collected in the tube AB is a measure of that evaporation. When the atmosphere is completely saturated with moisture, or when the evaporation ceases, the temperature of AB will be the same as that of any other part of the tube, and the distillation therefore, for the reason already stated, will also cease.

The measure of evaporation thus found, is expressed in inches and decimals of an inch, by means of an attached scale GH, the divisions of which are determined by experiment. Suppose, for example, that the instrument is exposed in similar circumstances with an evaporating basin, and that the quantity evaporated from the latter in a given time, as determined either by weight or measurement, is found to be one-tenth of an inch, while the alcohol distilled by the former in the same time, fills the tube AB to the depth of one inch; then the scale being divided into inches and tenths, will indicate tenths and hundredths of an inch of evaporation. By increasing the proportion between the diameters of EF and AB, the quantity of evaporation may be measured to any degree of minuteness required. In using the instrument, the tube EF is to be sheltered from rain by enclosing it in a case or cover, to prevent its temperature being reduced below that of the atmosphere by subsequent evaporation, and the bulb BC is to be kept constantly moist by means of a small cup containing water attached to the tube immediately below it, the silk or paper being in contact with the water, or from an adjoining vessel, as in the case of the hygrometer. The instrument is placed in a vertical position, and is prepared for a new observation by inverting it, so that the distilled alcohol may be conveyed back to the tube EF. It is to be hoped that this beautiful and ingenious contrivance, will soon meet with that reception among meteorologists, to which its merits so well entitle it. The instrument is found to possess the utmost delicacy; and it is probable that it may, in time, supersede the use even of the hygrometer.

QUERIES.

How spruce beer may be made in the best manner?

To make vinegar in a short time?

LECTURES AT THE ROYAL INSTITUTION.

POTASSIUM. SODIUM.

Lecture 31. Mr. Faraday began his lecture by describing the method usually employed to determine the quantity of pure carbonate of potassa in the different carbonates which are met with in commerce. This is to the manufacturer who uses potash a matter of considerable importance, and various methods have been employed for the purpose. The best consists in ascertaining what quantity of any acid, and sulphuric acid is generally employed, will neutralize a given quantity of pure carbonate of potassa; and when this is ascertained we have a test of the purity, and consequently the value, of any sort of pearlash or potash, in the quantity of sulphuric acid necessary to neutralize it. Thus, if 100 parts of pure carbonate of potassa require 70 parts of pure sulphuric acid to neutralize it completely, and if we put 70 grains of the acid into a tube graduated to 100 parts, and fill it with water, we shall have an alkalimeter always ready. If 100 grains of the alkali brought to be tried requires the whole 100 measures of the acid solution to neutralize it, and we ascertain this by mixing them gradually, and testing the mixture with litmus paper, it may be considered as pure carbonate. If, on the contrary, it requires only 60 parts of the solution of acid, then the carbonate is said to contain only 60 per cent. of the alkali. The quantity, then, of an acid required to neutralize the carbonate is a test of its goodness. In commerce this test is of considerable importance, from the number of uses to which the carbonate is put. It is employed in the manufacture of glass, of soap, of alum, of prussian blue, and, in some countries, of nitre.

The *bicarbonate of potassa* consists of two proportionals carbonic acid, 44, and one proportional alkali, 48, and is obtained by passing carbonic acid through a solution of potash. Even this additional quantity of carbonic acid does not neutralize the alkali. The salt is obtained crystallized, and has a slightly alkaline taste; it is soluble in water, but requires four times its weight to dissolve it. In its crystalline state it contains one proportional of water, and therefore consists of 92 carbonate, 9 water. If heated, some of the carbonic acid flies off, and a *sessquicarbonate* is formed.

With *cyanogen* potassium forms a grey cyanuret of potassium; but of this salt Mr. Faraday said he should not speak further till he came to treat of the salts of iron.

Boron and potassium form salts which have been scarcely examined, and, as far as they have been examined, are not found to be of any importance. The general characteristics of the salts of potassium are solubility in water and giving no precipitates with pure alkali or with the carbonates of the alkalies. They are fixed in the fire,—a characteristic which is even possessed by the carbonates of the alkalies. The salts of potassium are distinguished from those of sodium and lithium by forming precipitates with muriatic and gallic acids; and if added to sulphate of alumina they cause it to crystallize, and alum is obtained.

Sodium, in most of its properties, resembles potassium, and was made known to the world by Sir H. Davy in the same Bakerian lecture in which he informed it of the existence of potassium. Like potassium, it is obtained by the action of the Voltaic battery, or by fire, substituting soda for potassa. It is more difficult, however, to obtain, and cannot be procured by the action of fire so readily as potassium. It is distinguished from potassium by being somewhat heavier, its specific gravity being 0.9348; and if thrown on water it does not take fire, but only smokes and floats about on its surface. It is soft and malleable, and may be pressed into plates and welded. It speedily

tarnishes on being exposed to the air, and if heated takes fire and burns readily. If the combustion be carried on with a limited quantity of air, the protoxide of sodium is formed; while, if there is excess of oxygen present, the peroxide of sodium results. We learn from the quantity of the oxygen the metal absorbs, that the protoxide is a compound of one proportional sodium, represented by 24, and one oxygen, 8, forming, by this union, the alkali soda, which has for its equivalent number 32. It combines with one proportional of water, 9, to form the hydrate of soda. The peroxide of soda differs from the peroxide of potassium, inasmuch as the latter is formed by three proportionals of oxygen, while the former takes only one and a half. The peroxide of soda is formed, as already stated, by heating soda in excess of oxygen, and it consists of one proportional soda, 24, and one and a half of oxygen, 12, its equivalent being 36.

The compounds of sodium and oxygen are never made directly. The protoxide of soda being extensively used in the arts, to obtain it pure it is only necessary to subject the soda of commerce or the carbonate of soda to the same process as is followed to obtain pure potassa. It is purified by alcohol in the same manner. Soda, in many of its properties, has a strong resemblance to potassa; it is the same sort of acrid corrosive alkaline substance. It is distinguished from potassa by effervescing when exposed to the air, and forming a paste, while potassa deliquesces. If tartaric acid also be added to a solution of soda in excess, it occasions no precipitate; but with a solution of potassa a small number of minute crystals are deposited; with acids, also, it forms salts, having very distinct characters.

Chlorine and sodium form, by their union, chloride of sodium or common salt. If sodium is burnt in chlorine there results a white compound of a pure saline flavour, soluble in water, and forming crystals when the water is evaporated. It is a compound of one proportional sodium, 24, and one proportional chlorine, 36, its equivalent being 60. When exposed to heat it fuses, but suffers no change; with a greater heat it sublimes over, and in this manner being employed as a coarse sort of glazing for common earthenware, it forms a rough but very permanent covering. The chloride of sodium is seldom made directly, common salt being obtained abundantly from sea water, and existing in various situations in the earth. To obtain it from sea water, the water is pumped into shallow pans, and evaporated either by artificial heat or by the action of the sun. When sufficiently evaporated the salt crystallizes. It is thrown out in heaps exposed to the action of the atmosphere, when the deliquescent salts with which it is mixed, such as the sulphate of magnesia, are formed and separate from it. Common salt, under the name of rock salt, is also found in vast pits in the earth, in different parts of the world, and is quarried out like the ores of metals. Sometimes it is quite pure, and at others mixed with earth, when it is dissolved and purified in the same manner as salt obtained from sea water. Chloride of sodium, or common salt, is put to various uses. As a condiment, or seasoning, as well as to preserve animal substances, it is very generally employed: it is the principal source of all the muriatic acid used, and of all the chlorine employed by bleachers; it forms a glaze for earthenware; it enters into the composition of several substances, and in small quantities is employed as a manure. We are indebted to Glauber for having first shown us how to obtain muriatic acid from salt, and he also taught the chemists that the residuua of their distillation, or the *caput mortuum*, were not, as they had generally supposed, inert.

Chlorate of Soda has been obtained by the same process as chlorate of potassium, which it resembles in its properties. The

action of iodine and sodium, and of iodic acid and soda, is like the action of iodine and potassium, and the resulting compounds resemble the iodides of potassium and the iodates of potassa. Nitrate of soda is only deserving mention as having formerly been called cubic nitre, from crystallizing in this form, and from being sometimes found mixed wite crude nitre. It may be formed directly by adding nitric acid to soda, and consists of 32 soda, acid 54, the equivalent for the salt being 86. When found native among saltpetre, it is difficult to account for its existence. In Peru, a large bed of it, extending above forty leagues, has been discovered, and it might be used instead of saltpetre to make gunpowder, furnishing a still larger proportion of oxygen; but it absorbs moisture from the atmosphere, and is thus rendered unfit for all pyrotechnical purposes.

The sulphurets of soda resemble the sulphurets of potassium, and sulphur does not combine with alkalies. Sulphurous acid forms a sulphite of soda, which has been put to no use. It consists of 32 soda and 32 acid, the salt having 64 for its equivalent.

Sulphuric acid and soda form *sulphate of soda*, or *Glauber's salt*, or *sal mirabile*, as it is or has been called. It is produced in abundance in the manufacture of muriatic acid, by the action of sulphuric acid on common salt; and the mode of procuring it, as well as its uses, were discovered by Glauber. It is a compound of one proportional of alkali, 32, and one of acid, 40, it being represented by the number 72. The dry salt is hard, white, and transparent; it has a saline and bitter taste, and is soluble in water. In its ordinary crystalline state it contains ten proportionals of water; but when set by to crystallize excluded from the action of the air, the first crystals which form in the centre are perfectly transparent, and contain only eight proportionals of water. When the air is admitted, the whole becomes solid, and the transparent crystals become immediately opaque. This change in the crystals has not been accounted for. The property of crystallizing suddenly when a saturated solution is exposed to the air, or when it is suddenly agitated, belongs only to sulphate of soda and acetic acid. When sulphate of soda is ignited with charcoal and lime, pure carbonate of soda is obtained. The lime takes the sulphuric acid, the carbon unites with the oxygen, and the carbonic acid forms with the soda carbonate of soda.

Bisulphate of soda is obtained by adding sulphuric acid to a hot solution of sulphate of soda: it is mentioned here as its place, but it is of no importance.

The different substances formed by the union of phosphorus and phosphoric acids with soda are of no importance. Phosphate of soda, however, the *sal perlatum* of some old writers, has been recommended as a medicine by Dr. Pearson, under the name of tasteless salts. Ammonio-phosphate of soda also is found in the fluids of the human body, and is employed as a flux, because it is a convenient means of furnishing phosphoric acid, which remains fixed in the fire, or bears a red heat without being decomposed. It is used for this purpose by some workers in metal.

The soda of commerce is a carbonate of soda; and carbonic acid and soda form two compounds, analogous to potassium, called the carbonate and bicarbonate of soda. Both are of an alkaline nature, though the bicarbonate is nearly neuter. They are obtained from the soda of commerce, as potassa is obtained from potash. The carbonate consists of one proportional soda and two of acid; the bicarbonate contains four proportionals of acid. The source of these carbonates, which are found in the rough state in commerce under the names of *kelp* and *barilla*, is seaweeds and marine plants, which are collected on the shores of the ocean in Spain, France, Scotland, and various other places, and burnt in small kilns, or in holes made in

the earth. Their ashes contain soda in an impure state, which may be obtained pure by the methods already pointed out. About 24 tons of sea-weed produce one ton of kelp, and this contains about five per cent. of carbonated alkali: when crystallized it contains seven proportionals of water. The bi-carbonate is much less soluble in water than the carbonate, and cannot be crystallized. The value of the carbonates of soda of commerce is determined by the alkalimeter, the same as the carbonates of potassa.

Boron and *sodium*, or rather *boracic acid* and soda, form the well-known salt borax. It is brought in an impure state from India, and is then called *tincal*. It is not a neutral salt, the borax possessing alkaline properties. More lately the boracic acid has been found in the Lipari Islands and in Tuscany; and borax is now manufactured in Britain and on the continent of Europe. Borax is used as a medicine, and as a flux: its composition is not exactly known, as the proportions of the elements of the acids are not ascertained.

The salts of sodium are generally distinguished by being soluble in water, not forming precipitates with pure or carbonated alkalies, or with muriate of platinum; and they do not convert sulphate of alumina into crystals of alum. The carbonates of soda are distinguished from the carbonates of potassa, by the former efflorescing, while the latter are deliquescent. Lithia will be the subject of the ensuing lecture.

EFFECT OF PROTECTORS ON COPPER.

Extract of a Letter from Charles Horsfall, Esq. to Dr. Traill.

Liverpool, Feb. 19, 1824.

The brig Tickler arrived here from Kingston, in Jamaica, about three weeks ago. She had been out on the voyage from this port to Jamaica and back, not quite five months; previously to her sailing she had been new coppered. Bars of cast iron three inches broad, and one inch thick, covering about 100th part of the surface of the copper, were placed upon each side of the keel from the stem to the stern, and fastened on with copper spike-nails. The Tickler went into the Graving Dock to-day. I attended before the water had quite left her; and immediately on the iron on the keel being visible, I went into the dock to examine it. The usual crust of red rust appeared upon it, but on applying a ship's scraper to it, I found the iron quite soft, to the depth of nearly half an inch. A quantity was scraped off which had all the appearance of black lead, and on handling, it soiled the fingers in the same way that black lead does, and became *quite hot* in the space of a minute or two; the inner part of the iron bar, or that next the copper, being quite hard. I wrapped a small quantity in paper, and put it in my pocket; and on taking it out again, in about a quarter of an hour, it had become very hot, and smoked, and soon assumed the appearance of rusted particles of iron. The bars of iron had been very little reduced in substance during the voyage.

With respect to the copper, such part of it as was not covered with barnacles appeared bright; and, as far as I could judge from such an inspection of it, as perfect and entire as when it was put on; but *I never saw a ship's bottom more thickly studded with barnacles*, nor any that were more difficult to scrape off. They were all rather small. It was only on the lower part of the bows, and about two inches above, and four inches below the iron bars, that the copper was not covered with barnacles; excepting the upper part of it which had been little under water.

Several vessels are expected to return from the East and West Indies in the ensuing month, having had *wrought* iron applied in the same manner that the *cast* iron was in the Tickler.

CHARLES HORSFALL.

The Editor of the Annals of Philosophy, from which we borrow this letter, says—

The first fact mentioned in Mr. Horsfall's letter has been long known. Mr. Daniell formed a similar substance artificially, eight years since, by immersing a cube of grey cast iron in diluted muriatic acid (see Journal of Science, vol ii.); and in the same Journal (vol. xii. p. 407), mention is made of a cast iron gun, which by long immersion in sea water was incrusted to the depth of an inch with a substance having all the exterior characters of impure plumbago. As to the state of the Tickler's bottom, it is obviously owing to the copper having been over protected. (See Annals of Philosophy, vol. viii. N.S. p. 364.) It is stated in the place referred to, that the requisite proportion of defending surface to that of the copper, as far as had then been ascertained, is somewhere between 1-120 and 1-220; the proportion at present adopted in the Royal Navy, we believe, does not exceed 1-300. In the preceding paper from the Philosophical Transactions, our readers will observe, that on sheets of copper defended by quantities of cast iron and zinc in a less proportion than 1-150, no deposition of alkaline matter or adherence of weeds took place, and the surface, though it had undergone a slight degree of solution, was perfectly clean, "a circumstance of great importance, as it points out the *limits of protection;* and makes the application of a *very small* quantity of the oxidizable metal *more advantageous* in fact than that of a larger one."

Mr. Horsfall's letter is a candid statement of a fair experiment, and the result, as far as it can be learnt, is the saving of the whole of the copper. Whether in short voyages the adhesion of small barnacles is a disadvantage which more than compensates this saving, we are ignorant; but if so, a *smaller quantity* of protecting surface must be used; and the exact proportions for different vessels and voyages will be known after a few experiments. Sir Humphry Davy is still earnestly pursuing his inquiries on this important subject; and, we believe, has discovered some new and interesting facts with respect to the conducting powers and electrochemical changes of metals in saline solutions; which enable him to preserve a considerable portion of the copper without any great consumption of oxidable metal. In the experiments now going on, a nail of zinc or iron is, we believe, placed *under* the copper, and in contact with it; and the moist paper upon the wood of the ship in which the nail is placed preserves the electrical circuit with the sea water; so that there is no appearance of protection on the *outside*, though each sheet of copper has its own protector of 1-300 or 1-400 its surface.

PREMIUMS OFFERED BY THE HAARLEM SOCIETY.

7th. As the power formerly attributed to plants, of improving the atmospherical air and adding to its oxygen, has been made doubtful by later experiments; and as it seems to be proved, that plants do not contribute to augment the oxygen, the Society therefore desires that it may be satisfactorily shown, both by experiment and observation, what relation the air has to plants, what substances the plants take from the air, and what they give it? What rules may be drawn from this knowledge for the improved cultivation of plants; and what information may we derive from it, for the completion of our knowledge of the physiology of vegetables?

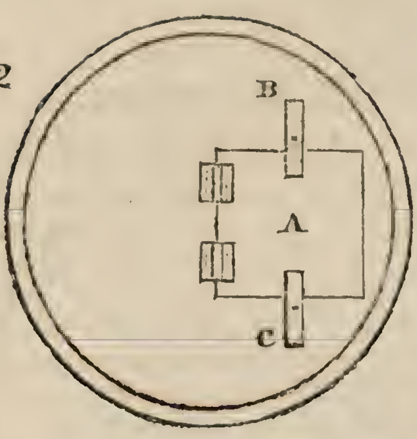
8th. In what manner does animal charcoal, which is employed to purify several different substances, and to bleach them, operate? In what respect and to what degree is its effect different from the effect of vegetable charcoal? How is animal charcoal best prepared, and how is it ascertained to be good or not?

9th. As several solutions of lead have very often had dangerous and fatal, though at first unobserved, effects on both men and animals; and as it now appears, that the species of animal charcoal obtained from ivory-black possesses the property of entirely decomposing solutions of lead, particularly those which are contained in water, the Society therefore wishes to have an analysis of ivory-black, as it is found in commerce, an explanation of its effects on solutions of lead, and the most simple and certain method of employing it, both in large and in small quantities?

LIQUID LEATHER.

A Dr. Bernland, of Larris, in Germany, is said to have discovered a method of making leather out of certain refuse and waste animal substances. A manufactory of this nature has been established near Vienna. No part of the process is explained, only it is said that the substance is at one time in a complete state of fluidity, and may then be cast into shoes, boots, and other articles of dress.

Fig 2



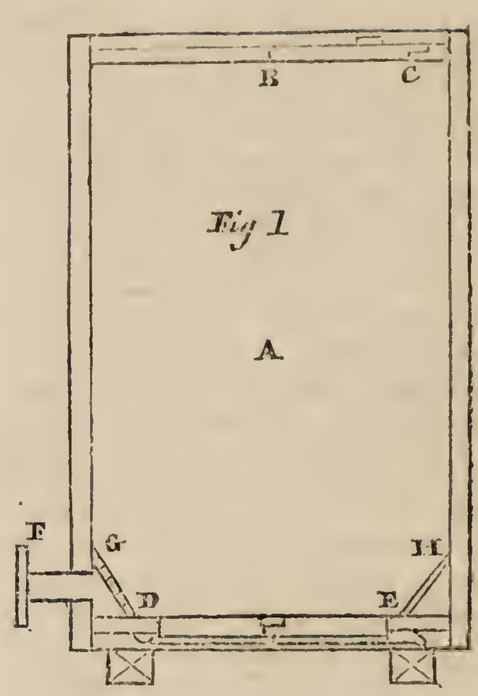
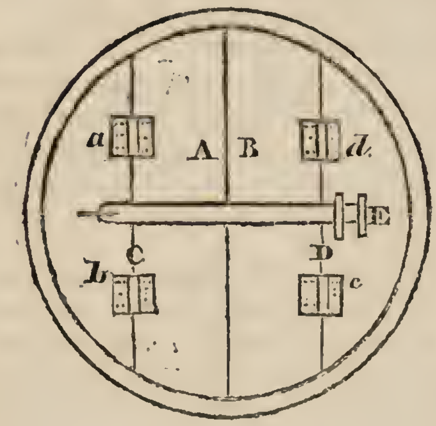


Fig 3.



POTATO SPIRIT.

(*From the Work of M. Dubrunfaut.*)

The alterations which have been lately made in our commercial regulations will give a great impulse to various branches of trade and manufacture. Distillation has, with other processes, been liberated from many restraints, and this chemical art will henceforth be cultivated with more zeal and with more success. Should the trade in corn be thrown open, so that we can obtain food and the raw material for distillation at the cheapest rate, there is no doubt but distillation, as well as other manufactures, will be much extended. Under this view of the matter, as well as to comply with the suggestion of a Correspondent, we shall now, in addition to what we have before said on the subject, describe the process of distilling from potatoes. We must, however, say to our Correspondent, that the report of Professor Oersted merely confirms the utility of the process described in The Chemist, as long ago as last August. (See vol. i. pp. 349. 352.) The Professor has recommended the two processes, in combination, described as above. Our Correspondent will not require to be informed, that corn spirit, and spirit from potatoes, may both be purified by the same means.

DISTILLATION FROM POTATOES.

There are two distinct methods of preparing potatoes for fermentation; one has a second object in view, namely, fattening cattle, and is well adapted to the country; the other has for its sole object, obtaining a good spirit. Both are intended to saccharize the fecula of the potatoes, which in one case is effected by malt, in the other by sulphuric acid. It must be recollected, that the quantity of spirit furnished by this root is always in proportion to the fecula or starch it contains. M. Dubrunfaut here gives a long list of the different proportions of starch obtained from different kinds of potatoes; but as we are not sure

of the corresponding English names of many of the sorts he mentions, we shall pass by this part of his work. It is plain, also, that the quantity of starch will vary according to the season, soil, and climate, in which the potato is grown. For all practical purposes, this can only be learnt by experience; and we shall not say any thing on it, except that, having stated the fact of the quantity of spirit being in proportion to the quantity of starch, we must recommend our readers to choose those potatoes for distillation which they find from experience to contain most fecula. In general, too, we may remark, that the poorest potatoes contain 15 per cent of their weight of fecula, and the richest from 27 to 28 per cent. The sort of potato much used in France to distil from is called *parmenture*, and is valued for this purpose on account of its thin skin, and on account of not having that peculiar strong taste which distinguishes some potatoes, and which injures the flavour of the brandy. The most favourable period for distilling from potatoes is from October till March. At the latter period they begin to germinate, the quantity of fecula they contain diminishes, and they produce less spirit. Temperature also has an influence on this circumstance, and great care must be taken not to allow the potatoes to freeze. To prevent this, they are preserved in deep cellars or holes, where the temperature never reaches the freezing point.

In the first method to be described, which has been long practised in this country, we believe, the potatoes are prepared for fermentation by malt, and the operation consists of three distinct parts. First, boiling the potatoes; second, reducing them to pap; third, fermenting them with malt. Each of these operations will be described. Formerly the potatoes were boiled for the distiller as they are boiled in families; but the difficulty of getting them out of the large vessels which were necessarily employed, soon obliged the distillers to give it up. The potatoes are now steamed, an operation which, in the distillery, may be performed at a trifling expense. The steam may probably be used as it rises from some of the other works going on at the same time; or it may be supplied from a cauldron, intended expressly for this purpose. The apparatus for steaming the potatoes consists in a cylindrical vessel A, Fig. 1st., or a wine pipe, or butt, will answer the purpose. It should be lined with lead or copper, and may be made to contain from 20 to 25 cwt. of potatoes; but it should never be filled, as the potatoes swell very much in cooking. The potatoes are put in by a trap-door in the top, BC, fig. 1st, and are removed by two trap doors, DE, placed in the bottom. Fig. 2 shows the top of the machine, A being the door, opening by hinges, and, when shut, kept fast by the pieces BC. Fig. 3 shows the bottom of the tub; AB are the doors, opening in the middle, turning on the hinges *a*, *b*, *c*, *d*, and which are fastened by means of the cross bar CE, and are opened by its removal. The steam is introduced at the tube F, and its opening is protected by a metal plate GD; H is a similar plate, and both serve to prevent potatoes lodging in the tub when it is emptied. The different parts of the apparatus, which might allow the escape of the steam, are luted with clay mixed with horse dung, or some similar lutes. It requires about one hour to fill this machine, to steam the potatoes sufficiently, and discharge them; so that, with a vat of the capacity mentioned above, from 12 to 15 tons of potatoes may be prepared in 12 hours.

When the potatoes have been sufficiently steamed, they are either mashed or ground in a mill adapted to the purpose. Formerly they were pounded in a mortar with a heavy pestle, now they are generally ground. The machine recommended for this purpose by M. Dubrunfant consists in a funnel-shaped box, down which the potatoes fall by their own weight, and, as they

reach the bottom, are caught between the teeth of two cylinders revolving horizontally, which bruise them to pulp.

To a quantity of this pulp, a quantity of ground malt is added, in a butt or tub, equal in weight to the 16th part of the pulp, and water is added of such a temperature as to bring the whole up from 30 to 35 Reaumur (about 100 to 110 Fahrenheit.) The mixture is stirred violently, and then it is allowed to remain at rest 15 or 30 minutes. Boiling water is then added to it till it reaches the temperature of between 145 and 155 Fahrenheit, the mixture being stirred, or otherwise moved, during the whole time. At the end of three hours, more water is added, so as to make the whole rather more than double the original quantity of potato-pulp and malt employed; and the water may be either hot or cold, as may be necessary to bring the mixture to a proper temperature for fermenting, or between 78 and 88. A quantity of good yeast being added, the fermentation commences in a few hours. The maceration with malt is found not to saccharize the potato completely; and the saccharization goes on during the whole time of the fermentation.*

This process is attended with many inconveniences; and M. Dubrunfaut recommended, in 1824, in a *Memoir*, which was honoured by the approbation of the Agricultural Society at Paris, that the starch should in the first instance be separated completely from the other parts of the potato, before it was submitted to the action of the malt. He proposed several machines and modifications for this purpose; but as this is quite distinct from the fermentation, and belongs rather to the extracting of starch from potatoes, we shall pass over this part of his Essay for the present, and come at once to the other method of

SACCHARIZING POTATOES BY SULPHURIC ACID.

This was originally discovered by Kirchoff, in 1811. He took a quantity of the starch of commerce, added to it four times its weight of water, acidulated with sulphuric acid, and boiled the mixture for 36 hours, in a leaden or silver vessel, stirring it the whole time. It then was a perfect fluid, and did not require to be stirred any more. As the liquid evaporated, water was added; and when it was sufficiently boiled, by adding chalk, and allowing it to settle, it is found to possess a sweet and agreeable taste. On being clarified with animal charcoal and white of eggs, and evaporated to the consistence of syrup, it was found to have an intense sweet taste, and to give crystallized sugar on standing to cool.

After Kirchoff made this curious discovery, the subject frequently underwent the examination of chemists. In 1812, Lampadius substituted starch obtained from potatoes for the starch of commerce; and, instead of boiling the mixture, he recommended it to be placed in wooden vessels, and heated by carrying a pipe conducting steam from a boiler to the bottom of the vessel. Up to that period no other method of obtaining alcohol from potatoes was known than the one we have described, which is attended with the serious inconvenience of distilling a pulp or semi-solid. The discovery stimulated the ingenuity and industry both of chemists and distillers, and the art of saccharizing the fecula, or starch, of potatoes, by sulphuric acid, is now an easy and every day process.

We must, however, postpone the further description of this till our next Number.

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* By turning to The Chemist, vol. i. page 349, the reader will there find M. Siemen's improvement on the above method described. Its object is to obtain a greater quantity of spirit from a determinate quantity of potatoes, and he asserts he has succeeded. The experiments of Oersted, referred to by our Correspondent last week, only confirmed the results of M. Siemen's experiments.

COMPOSITION FOR MAKING LEATHER, &c. WATER-PROOF.

Mr. J. Mills and Mr. H. W. Fairman have taken out a patent for the following composition, to be applied to leather, canvas, &c., to make it perfectly water-tight. The cloth done over with it becomes sufficiently hard and dry not to be sticky, and to be elastic and pliable. The composition consists of pipe-clay and oil varnish. The varnish is prepared by mixing linseed oil in the proportion of 100lbs. with six pounds and a half of sacharum saturnac, one pound and a quarter of burnt amber, one pound and a quarter of white lead, and one pound of fine pumice stone. These ingredients, after being well ground and mixed together, are to be boiled for ten hours over a slow fire, increasing the heat gradually during the last two hours, but taking care the oil does not run thick. This part of the process requires experiment and observation to practise it, as much depends on the nature and quality of the oil. If it be adulterated or mixed with other matters it will not stand boiling without coagulating; and the varnish should be so thin, that when mixed with pipe-clay, it should not be thicker than molasses. After the varnish has been suffered to settle for at least one week, it is drawn off and strained through muslin, or some other suitable strainer. A quantity of pure pipe-clay, equal in weight to one third of the clarified varnish, is to be pounded and sifted, and mixed with a quantity of glue-water, stirring the two ingredients well together, till the consistency of the mixture is that of thin salve. The varnish is then to be gradually added, the mixture being continually stirred with wooden instruments. It is then to be ground in a colour mill repeatedly, till the whole runs out in the state of a thin liquid. Any colour may be given to it by grinding oil colours in the varnish, and adding them in the proportion of one-fourth colour to three-fourths varnish. The varnish is spread by means of large knives made of cast steel. The linen or other article being extended on frames, and covered on both sides, the varnish dries in about a week, so that the article is then fit for use.

A gloss or japan is afterwards made by gently boiling fifty pounds of the above varnish with five pounds of clarified resin, until it is dissolved, and adding two pounds of turpentine when the mixture is cold. Some colour corresponding to that already given to the articles, is well ground and mixed with this composition, which is then also strained. When the articles are perfectly dry, they are rubbed down with pumice stone and water; are afterwards washed with clean water and a sponge, and allowed to dry. Two or three coatings of the japan may be laid on with brushes, allowing two or three days for the drying of each coating. The cloth or leather is then water-tight, pliable, and of a shining appearance.

ENGRAVING ON STEEL.

In 1812, Mr. Watt suggested the possibility of engraving on steel; and Mr. Charles Turner endeavoured, but unsuccessfully, to carry his suggestion into effect. It was not however till Mr. Perkins had discovered the method of decarbonating steel, mentioned in one of our late Numbers, that steel plates were obtained soft enough to be engraved on. Since that time steel plates have become popular with artists; and they give them a decided preference to copper plates for mezzotinto engraving. The tones are better defined, the clearness of the lighter tints is superior, the darks are richer, and all the deficiencies of mezzotinto engraving are now mastered by using steel instead of copper. The process is longer and more tedious, but the result is so satisfactory as fully to reward the additional labour. The best plates are said to be manufactured by Mr. Rhodes and Mr. Hoole of Sheffield. Great care is necessary to preserve them from rust; they should be kept in a

dry room near a fire, and be rubbed over with mutton suet.

At present the art of mezzotinto engraving on steel is carried to great perfection. For a long time, however, there were great difficulties in procuring a menstruum for *biting in* the steel plates. Nitrous acid, which is used for biting in copper plates, deposits the oxide of iron after it is formed, and thus prevents the action of the acid on the part it is requisite to remove. Various experiments have been tried to get over this difficulty; nitrate of copper in solution was used, but the results were unsatisfactory. Mr. Edmund Turrel at length has announced to the Society of Arts, that he has discovered a menstruum proper for etching on steel, and the Society rewarded him with their large gold medal for the communication. Nitric acid, in a state of dilution, acts well on steel; but after a short time the peroxide of iron is formed, which precipitates, and impedes and renders irregular the action of the acid. Mr. Turrel first endeavoured to conquer this difficulty by adding pyrolignous acid, which in part succeeded. Not satisfied, however, with this, he resolved to try alcohol or ether, as they are known to have a deoxydizing effect, and might, he thought, keep the iron in the state of peroxide, when it is soluble in nitric acid. This succeeded: the menstruum corroded the steel with great facility, producing clear and deep lines, and the formation of peroxide is so completely prevented, that after keeping some of the liquid which had been used, for six months, there was no visible precipitation. To form the menstruum, take, by measure, four parts of the strongest pyrolignous acid, (acetic acid,) one part of alcohol, or highly rectified spirits of wine, mix them, and agitate them gently for about half a minute; then add one part of pure nitric acid: when the whole are thoroughly mixed, the liquid is fit to be poured on the steel plate. Very light tints are corroded in about one minute, or little more; a considerable degree of colour may be produced in a quarter of an hour. The effect is heightened by increasing the proportion of nitric acid and retarded by lessening it.

When the menstruum is poured off the plate, it should be instantly washed with a liquid consisting of one part alcohol, and four parts water. The best material for stopping out any parts which are sufficiently corroded, is pure asphaltum dissolved in essential oil of turpentine, of a consistency to flow freely from a hair pencil. All the ingredients employed should be pure.—*Abridged from the Transactions of the Society for the Encouragement of Arts, &c.*

ROMAN ARTIFICIAL PEARLS.

These pearls are greatly esteemed in Italy, and seem superior to all other artificial pearls. The mode of making them is thus described, in the Technical Repository, by H. W. Reveley, Esq. The nucleus or basis of these pearls is formed of small pieces of fine grained alabaster, such as we see imported in the form of vases, &c, and which may be easily worked. Holes are drilled through small blocks of this substance, and which are then shaped on the lathe, or by the knife; the country people in Italy prefer the latter. These little blocks are afterwards coated. For this purpose the pearly and shining part of the inside of oyster and other shells, is carefully separated from the white, opaque, and rough parts, and is reduced to fine powder, which is mixed with a solution of isinglass in proof spirit, or with white transparent size of proper consistency. The beads are stuck on the points of slender pieces of bamboo, and dipped into the solution above mentioned; and then the other end of the pieces of bamboo are stuck in earth contained in pots, so as to stand upright, and at such a distance as to keep the beads from touching each other. This is performed in a warm room, and as soon as one coat is dry, the beads are again dipped in the pearly

composition, and the operation is repeated until the beads are sufficiently coated. Beads so made, are found extremely durable, and not so liable to injury as those made of glass bulbs, coated interiorly with the powder of the scales of the bleak, fixed with isinglass and afterwards filled up with wax.

CONDENSATION OF HYDROGEN AND OXYGEN BY PLATINUM.

Döbereiner has ascertained that *moist* as well as *dry* platinum causes the mutual condensation of these two gases. The effect in both cases is equally complete; the only difference being in the length of time necessary to produce it.

The best method of performing the experiment is to ignite at the bottom of a glass tube closed by fusion at one extremity, a quantity of the double ammonio-muriate of platinum, or to decompose in it a solution of platinum by means of a rod of zinc. In either case, a thin film of platinum is deposited upon the interior of the tube, and adheres with considerable firmness. If a tube thus prepared be filled with a mixture of hydrogen and oxygen (or atmospheric air), and inverted over water, the whole of the hydrogen will be condensed into water in the course of a few hours. A similar result is obtained by placing a mass of spongy platinum well soaked with water into a receiver filled with the mixture of the two gases. He next examined what would be the effect of moistening the platinum with other liquids. With alcohol the experiment succeeded equally as well as with water; but not the slightest condensation took place when the spongy metal was imbibed with nitric acid, or with liquid ammonia. He ascribes these differences exclusively to the gaseous mixture being absorbable by water and alcohol, but not by nitric acid or liquid ammonia: in the former case only, the gases would be conveyed into immediate contact with the metal. Döbereiner concludes with observing, that the existence of some peculiar and independent property in the platinum is more decisively evinced by the present experiment than by any other which he had heretofore made.

These experiments suggested an easy method of depurating hydrogen from minute traces of oxygen. All that is necessary is to enclose it in a stoppered phial, a portion of the interior having been coated, by the process just described, with a thin incrustation of platinum. The oxygen will by degrees undergo condensation.—*Schweigger's Neues Journal für Chemie und Physik*, xii. 60.

NERVES THE SOURCE OF ANIMAL HEAT.

In a paper by Sir Everard Home, On the Influence of Nerves and Ganglions in producing Animal Heat, read at the Royal Society on March 17, he observes, that wherever the power of generating heat exists, there nerves also exist in abundance. The converse of the proposition, however, does appear to be true; for there are animals, such as the snail, the water muscle, and the oyster, which possess both brains and nerves, and yet seem destitute of the power of generating heat. Sir Everard found the heat of a deer's horn, while inclosed in its velvet, in the month of June, 96°. The horn was then one foot long. At the top of the antler, in the following month, it was 99°. This proved a power of generating heat at a distance from the brain and heart. It was ascertained that nerves accompanied the blood-vessels in great abundance. On dividing the trunks of the nerves supplying the velvet of one horn while the others were uninjured, it was found, on the day after the operation, that the temperature of the former had sunk 12° below that of the latter, and on the following day it had sunk 26°, the temperature of the injured

horn being only 3° above that of the atmosphere. After this the temperature of the wounded horn increased, owing probably to some connexion having taken place between the nerves of the horn and those of the head, though the nervous trunk had not united.

THE CLIMATE OF THE ANTE-DILUVIAN WORLD.

(*Continued from p.* 445.)

After the author has shown, from the difference of the *Floras* of any two parallels of latitude and the resemblance of that buried *Flora* which is found mingled with coal, and far below the surface of the earth, that the temperature of the earth was formerly different from what it now is, he goes on to show, by other arguments, that the heat of the globe is independent of solar influence. The first argument is drawn from the temperature of springs:—

Springs exhibit two distinct set of phenomena; first, the constancy of their temperature under all varieties of seasons; and, secondly, the difference of their respective temperatures as they rise from different depths. To such an extent does the central cause of heat counteract the agency of the seasons, that mineral springs which rise at no great depth remain of an almost uniform temperature throughout the year. The temperature of one near Berlin, similarly situated, was examined at different periods by two very accurate observers, Wahlenberg and Erman. The former found that the heat of the source did not vary more than 0·25 of Reaumur from August to the month of April following. Erman, in a subsequent series of observations, did not find it to vary more than 0·05, and he ascribes the difference of the results to the greater accuracy of his instruments.

The deeper the sources of tepid and hot springs are, so much hotter in general is the water which rises from them. The tepid springs of Matlock and Buxton rise in the immediate vicinity of amygdaloid and basaltic rocks, and hotter springs seem to come from still greater depths. The celebrated and learned Humboldt says, that the hot springs in various parts of South America arise from the granitic and primary strata. As to the hypothesis of their deriving their heat from the chemical decomposition of sulphurets, &c. the limited and changeable operation of such a cause, compared with the permanency and greatness of the effect, are sufficiently strong reasons to make us abandon this explanation.

The author then brings forward the heat of the interior of the earth, as ascertained by the heat in different mines, and exemplified in the following passages:—

Whitehaven Colliery, Cumberland.

	Fahr.
Average temperature of a spring at the surface	49
Ditto of water at the depth of 480 feet	60
Air at the same depth	63
Air at 600 feet	65

Workington Colliery, Cumberland.

A spring at the surface	48
Water at the depth of 180 feet	50
Ditto at the depth of 504 feet below the level of the ocean, and under the Irish Sea	60

Teem Colliery, Durham.

Water at the depth of 444 feet	61

Percy Mine Colliery, Northumberland.

Average temperature of water at the surface	49
Water 900 feet deeper than the level of the sea	68
Difference	19

Jarrow Colliery, Durham.

Average temperature of water at the surface	49
Water at 832 feet	68

Killingworth Colliery, Northumberland, (being the deepest Coal Mine in Great Britain).

Water at the surface	49
Air at 790 feet deep	51
Ditto at 900 from the surface, after having traversed a mile and a half from the downcast pit	70
Water at the great depth of 1200 feet	74

Baron Humboldt informs us that the mine of Valenciana is so warm, that the miners are constantly exposed to a temperature of 91·4 of

Fahrenheit, while the mean temperature of the external air is 60 8. The springs which issue from veins of the same mine at the depth of 1638 feet, have a temperature of 98·2, which is 5·4 warmer than the air of levels in which the miners work; and this fact is of itself, when added to Mr. Bald's observations on the water in mines, sufficient to set at rest for ever the supposition of the heat being owing to the miners, their horses and lights, &c. The health of a miner requires a constant circulation of air, which renders the heat of mines more remarkable.

The average temperature of air at the mouth of the mine of Reyas, near that of Valenciana, was	69·4
Air at the depth of 630 feet........	92·7

Mr. Bald very properly remarks, that the heat of coal mines cannot arise from the decomposition of sulphurets, for these never suffer decomposition *in situ;* if they did, the greater part of the coal mines in the world would have been destroyed by spontaneous ignition. In the mina Purgatoria, the height of which above the level of the sea is equal to the Pic of Teneriffe, the air in the mine was 67·3 Fahrenheit.

It is evident that the elevation of a mine above the level of the sea does not regulate its temperature as it does that of the surface. Water at the depth of 1200 feet under the sea in the Killingworth Colliery, was stated to be 74° Fahr.; while the air at 436 feet deep, in the mine of Villapenda, in Mexico, and which is more than 3000 feet above the level of the sea, is 84·9.

When the phenomena of the antediluvian Flora, and the laws of vegetable life, are considered in connexion with all that has been adduced, we are necessarily led to the same conclusion to which many celebrated geologists have arrived, partly from taking a different road of inquiry, and partly from conjecture; namely, that there is a source of heat in the centre of the earth itself, which must be referred to, as the cause of the uniformity of temperature of the ancient world.

(*To be continued.*)

DICTIONARY OF CHEMISTRY.

Hydrophosphoric Gas, *bihydroguret of phosphorus.* A compound of phosphorus and hydrogen.

Hydrophosphorous Acid, *phosphorous acid and water.*

Hydrophosphuret of Lime. A substance bearing this name is obtained when phosphuret of lime is formed.

Hydropneumatic Apparatus.—The pneumatic apparatus in which water is used is so named to distinguish it from the *mercurio-pneumatic apparatus.*

Hydrosulphurets. Compounds of sulphuretted hydrogen with salifiable bases.

Hydrosulphuret of Ammonia is much used as a test for metals.

Hydrosulphuric Acid, *hydrothionic acid.* The *sulphuretted hydrogen* of the English chemists has received both the other names from the French chemists, though the terms *hydro-thionic acid* are confined to the aqueous solution of sulphuretted hydrogen.

Hydrurets. Compounds of hydrogen and the metals.

Hygrometer. An instrument employed to show the presence of moisture in the air, to indicate its variations, and enable us to ascertain the actual quantity of water in a given bulk of air. Saussure, who was the first to make such an instrument on principles approaching to accuracy, employed a human hair, which, as it dilates by moisture and contracts by dryness, moves an index. Deluc used a thin strip of whalebone; and various other contrivances have been resorted to. At present Mr. Daniell's hygrometer is the one most approved of.

Hygroscopes. Instruments for the same purpose as hygrometers.

Hyosciama. A vegetable alkali, extracted by Dr. Brandes from the *hyosciamus negri*, or *henbane*. In examining the alkaline principles of narcotic plants, great circumspection is necessary. In them resides the whole poisonous properties of the plant; their vapour is extremely prejudicial to the eyes, and, fasting, the smallest portion is dangerous.

Hyperoxymuriates. The former name for those salts now called *chlorates*. Compounds of chloric acid with bases.

Hyperstene. *Labrador schiller-spar.* A mineral of a copper-red colour, out of which rings, brooches, &c. are formed. Its constituents are silica 54.25, magnesia 14, alumina 2.25, lime 1.50, oxide of iron 24.5, water 1, and a trace of manganese.

Hyponitrous Acid, *per-nitrous acid.* A compound of oxygen and nitrogen, intermediate betwixt nitric oxide and nitrous acid.

Hypophosphites. Compounds of hypophosphorous acid and bases.

Hypophosphoric Acid, *phosphatic acid.* Supposed to be a compound of phosphoric and phosphorous acids with water.

Hypophosphorous Acid. The acid combination of phosphorus and oxygen which contains the least quantity of the latter substance.

Hyposulphates. Compounds of hyposulphuric acid and bases. The only one of any consequence, as giving the hyposulphuric acid, is the hyposulphate of baryta.

Hyposulphites. Compounds of hyposulphurous acid and bases. The only one of these salts that is of much importance is the hyposulphite of lime, in which the combination of the acid is most distinct.

Hyposulphuric and Hyposulphurous Acids. The acids forming the salts just mentioned can scarcely be said to exist except in combination with bases. For our knowledge of these salts we are chiefly indebted to Mr. Herschell.

RICE PAPER.

The substance called rice paper, which is brought from China, and much used for representing richly-coloured insects and other objects of natural history, and for making artificial flowers, is ascertained to be a vegetable production. On being exposed to the action of boiling olive oil it was made transparent, and thus its structure was ascertained. It consists of long hexagonal cells, their length being parallel to the surface of the film. When in its usual state these cells are filled with air, which renders it soft and well adapted to many purposes. It is said to be the membrane of the bread-fruit tree, the *artacarpus incisifolia* of naturalists.—*Edin. Journal of Science.*

TO READERS AND CORRESPONDENTS.

The Index to the Second Volume of The Chemist will be published the ensuing week.

If "A Subscriber," who writes from Maidstone, will refer to No.52, page 376, he will find what he inquires after.

"A Constant Reader" will also find the first of his Queries already answered in No.30, page 31. To his last Query it would be difficult to give an answer, unless the other ingredients of any composition were known.

"J.R." and "E.C.S." are informed, that there is no means of obviating the return of the hair to its natural colour. As it grows, so as to make the dye perceptible, it must be re-dyed. Cosmetics of all descriptions must, if used at all, be continually used, or nature will soon overtop art.

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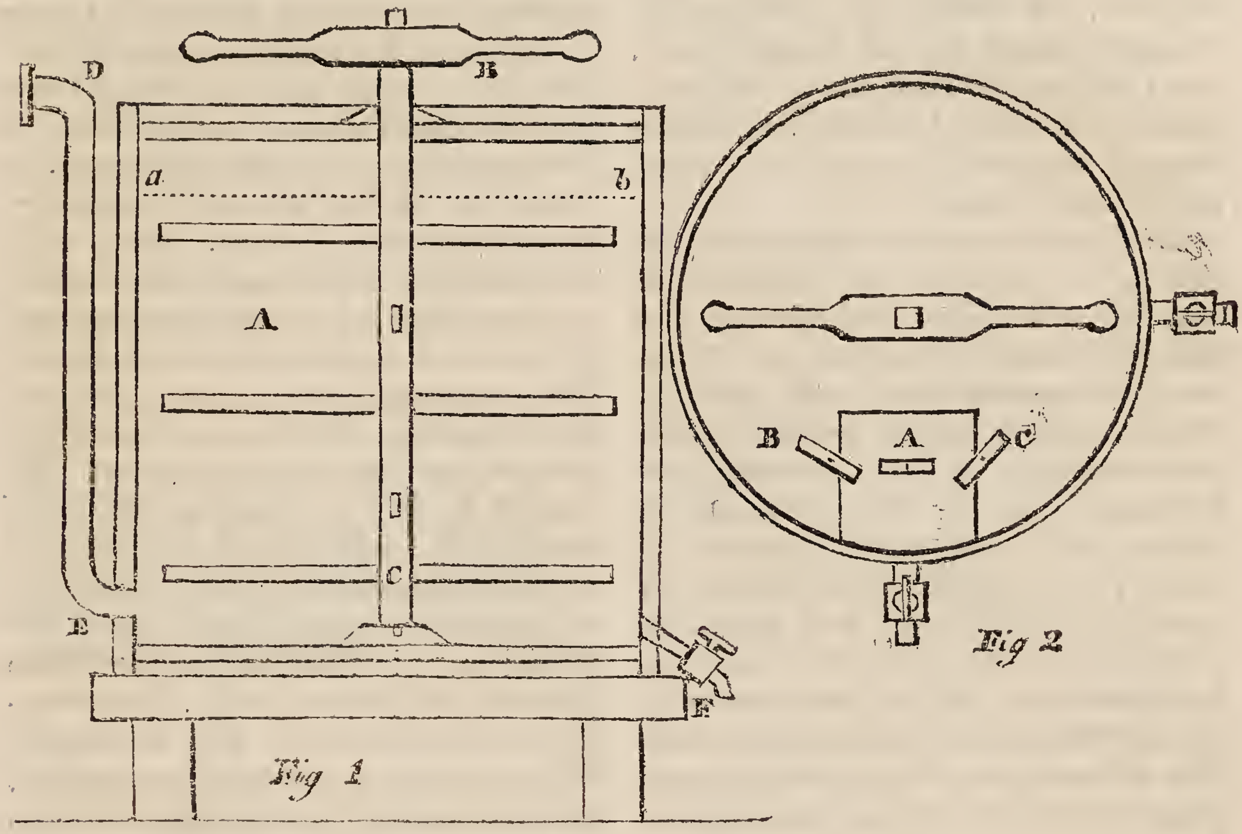

Fig 1 *Fig 2*

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SACCHARIZING POTATOES WITH SULPHURIC ACID.

(*From the Work of M. Dubrunfaut.*)

(*Continued from p.* 458.)

THE apparatus this gentleman recommends is seen in our plate. A is a strong or solid vat lined with lead, and capable of containing, when filled up to the dotted line, *a b*, between 430 and 460 gallons. An agitator, B C, is fixed in the centre, having several arms, destined to give every part of the liquid a continual motion. D E is a leaden pipe, intended to convey steam to the interior of the vat. At the end D is a flange for connecting it more conveniently to the steam cauldron. F is the dis-

charging cock. Figure 2d is a bird's-eye view of the vat. A is a trap-door, which is removed to put the liquid into the vat, and which can be easily fastened by means of the two buttons, BC. The cock D is about an inch and a half from the bottom of the vat, and by its means the clear liquid may be drawn off, while at F the deposit may be extracted. A vessel of the capacity recommended by M. Dubrunfaut, or of 20 hecatolitres, about 530 gallons, may serve for 300 kilogrammes, or about 662 pounds of potato starch each time.

In beginning the operation 600 litres, or about 158 gallons of water, are first put into the vat, and this is heated by means of steam to the temperature of boiling. While this is going on the necessary quantity of potato starch, 300 kilogrammes, or 662 pounds, is mixed with 600 kilogrammes of water, (by weight 1324 pounds, or nearly 160 gallons,) and about 13 pounds of the sulphuric acid of commerce at 66, or two per cent. of the weight of the fecula used. The diluted fecula is then poured gradually into the vat through the trap-door, the agitator being constantly kept in motion. The water at the temperature of boiling in the vat, together with the sulphuric acid mixed with it, soon liquefy the whole mass. It is quite essential to success not to pour the whole of the potato starch in at one time. The quantity mentioned above should be poured in at three different times. The first portion cools down the water considerably, but the constant addition of steam soon raises it again to the boiling temperature. When this has arrived, the second portion may be added. Of course the temperature is again lowered, the mixture is momentarily thickened, and in a certain time again liquefied, and the temperature again raised. When it has reached about 200°, the third and last portion of the diluted potato starch is added, the agitation is continued, and the steam added till the whole has again reached 212°. The trap-door is then carefully shut and closely luted, and the vat is allowed to remain undisturbed for six hours. Formerly the temperature was kept up to that of boiling water by a constant addition of steam; but closing up the vat is found to answer the same purpose, and to save all the fuel and trouble of constantly adding steam for six hours. At the end of this time the whole of the fecula should be saccharized. A greater proportion of sulphuric acid may be used than is mentioned above, which hastens the process; but two per cent. is sufficient if the whole be allowed to remain six hours. The only means of ascertaining if the whole of the starch has been saccharized is to test it with *iodine*, which shows the presence of starch, by a blue or violet colour, whether it is merely suspended in the water or dissolved in it. A small quantity of the liquid is drawn off and tested at different periods; and when the colour is no longer changed by the addition, it is time to proceed with the rest of the operation. The trap-door is opened, and the sulphuric acid, which is never decomposed, and is found in the liquid as it was put in, must be neutralized. By adding lime or carbonate of lime (chalk) to the mixture, an insoluluble precipitate is formed. If lime be employed, care must be taken to put in the precise quantity necessary to neutralize the acid, as either more or less is injurious to the fermentation. If chalk is used, a little excess in the quantity is of no importance. To neutralize the acid, two-thirds more chalk is necessary than there was acid employed, or for the 12 pounds of acid we must add about 20 of chalk. It is reduced to powder, mixed with about three times its weight of water, and gradually added to the saccharized starch, stirring the mixture. The instant the chalk meets with the sulphuric acid an effervescence takes place, owing to the disengagement of carbonic acid, and the chalk must be added till this effervescence ceases; but about the quantity above stated will be sufficient. It

is by this test that the workmen decide when enough has been added. In the course of half an hour, during which the liquid is allowed to settle, the whole of the sulphate of lime formed by this operation is deposited. The liquid when quite clear is drawn off by the cock D, and is carried or run into the fermenting vat. The deposit is extracted at F, and thrown on strong cloth, so that it may drain, and the drainings are added to the other liquid. Taking into account the steam which has been condensed in heating the mixture, it is found that the product altogether consists of 1600 litres, or about 422 gallons, as follows :—

	Galls.
The water first put in the vat 600 litres .... =	158
The starch was moistened with 600	158
Taking the specific gravity of the starch at 1500 *grammes* the *litre*, we shall have for the volume of the 300 kilogrammes 200 litres ..	53
In heating this would condense about 200 litres of water	53
	422

The specific gravity of this liquid will, in this state, correspond to nine degrees of Baumé's aerometer. Many distillers distil it at this density; and for this purpose they leave it in the fermenting vat till it has cooled down to 80° or 86°, and then they add the yeast. M. Dubrunfaut, however, recommends that the specific gravity should be reduced to 5° or 6° of Beaumé, by the addition of cold water, which hastens the fermentation and produces more alcohol. At present, at Paris, from 20 to 25 litres, five to six gallons, of brandy at 19°, are obtained from fifty kilogrammes (110 pounds) of potato starch; but this quantity, he thinks, may be increased by diminishing the specific gravity of the liquid, as he recommends. After entering into some calculations, to show that the quantity of alcohol now obtained from potatoes is not so great as theory would lead us to hope they will give, M. Dubrunfaut concludes, by remarking, that there is yet much to be done in transforming the starch of potatoes into alcohol to bring the process to perfection. We recommend this to the notice of our friends engaged in the manufacture of ardent spirits. The theory of this curious transformation we shall lay before our readers at a future opportunity.

ELECTRICAL EFFECTS BY CHEMICAL DECOMPOSITION.

M. Becquerel has published, in the *Annales de Chimie et Physique* for January 1825, an account of some curious experiments on the electrical effects which are produced during chemical decomposition. Of some of these experiments the following is a brief abstract:—M. Thenard discovered that all the metals, with the exception of iron, tin, antimony, and tellurium, have a tendency to decompose the peroxide of hydrogen (oxygenated water), the most oxidable become oxidated, and at the same time cause a separation of oxygen; while those not so oxidable preserve their metallic lustre. A great number of other bodies also decompose oxygenated water. M. Becquerel has examined the electrical effects which take place, 1st, when the metals, and, 2d, when the metallic oxides are brought into contact with oxygenated water.

The best manner of submitting oxygenated water to the action of those metals which decompose it, without themselves undergoing an alteration, is to form them into metallic sponges, such as are obtained by heating the ammoniacal chlorate of platinum to redness. To begin with platinum: a spoon of this metal is fixed to the thread at one of the extremities of a very sensible galvanometer, while to the other is attached a *spongy* mass of the same metal. Water containing from seven to eight times its volume of oxygen is poured into the spoon, and the metallic sponge is plunged into it; instantly there arises around it a considerable effervescence by the disengagement of oxygen, and then an

electrical current, which goes from the oxygenated water to the sponge, as if there were a chemical action. This current is owing entirely to the decomposition of the oxygenated water, for the platinum of the spoon and that of the sponge being both exposed to the contact of the liquid, and suffering the same action, the electrico-dynamic effects ought to be neutralized, or destroy each other. In other words, the galvanometer should not be affected. It is also easy to prove that the change of temperature which takes place during the decomposition is not the cause of this current. The sponge, in fact, ought, as metals are better conductors of caloric than liquids, to be heated more than the water; and the current should, did it arise from change of temperature, pass from the sponge to the water, agreeably to the results of former experiments. As the peroxide of hydrogen is very difficult of preparation, it is proper to operate on very small quantities, and the platinum spoon should not be above an inch in diameter, and the sponge of a proportionate size. Gold is prepared for the same operation by reducing the *hydrochlorate* of gold by means of the sulphate of iron; a portion of it is then minutely divided, put on charcoal, or in a glass tube, and heated, so that the parts adhere together and form such a solid mass as can be attached to the galvanometer, the other end of which is connected with a gold spoon. Silver is precipitated from the nitrate of silver by copper, and formed into a sponge. With both silver and gold the effects are the same as those observed of platinum.

Another method for observing the same phenomena consists in attaching to one of the ends of the galvanometer a plate of metal, and to place on it portions of the same metal,—elevate the temperature so that they may adhere; pour on the minutely divided portion oxygenated water, and touch the liquid with a plate of the same metal, attached to the other end of the galvanometer. It is only necessary in this case, to take care that the two plates of metal are precisely the same as the minutely divided portion; and to remove every foreign matter which may adhere to their surface.

The electrical phenomena which manifest themselves when the peroxide of hydrogen is brought into contact with a metal which absorbs a portion of its oxygen, arise both from the decomposition of the peroxide and the oxidation of the metal. The electrical current which is observed is the sum or difference of the two partial currents, as they move in the same or in opposite directions. But these effects vary often without our being able to appreciate the causes of these variations. Still, in general, M. Becquerel asserts, the motion of the electrical or galvanic current is the same as with metals which do not undergo oxidation.

From these and various other experiments, this gentleman thinks chemical and electrical action are both derived from one and the same cause, which is electricity. Into this theory we shall not enter, further than to observe, that it is no explanation of one set of phenomena to refer them to another set, which are equally unexplained. Rightly understood, *electricity* is only a general term for the supposed cause of a great number of curious effects, or it may be considered as standing for all these effects. If those other effects now attributed to chemical affinity were, in all cases, precisely the same as electrical effects, it would be right to attribute both to the same cause. Till it is distinctly shown that those effects we now say are caused by chemical affinity are precisely the same, and follow the same laws as those effects we say are caused by electricity, such a further generalization as that of M. Becquerel, lumping, as it does, two classes of distinct phenomena under one unknown cause, even although electrical and chemical effects were invariably conjoined, cannot have our approbation. His

experiments are, however, curious; and the rest of them we shall give in a subsequent Number.

DICTIONARY OF CHEMISTRY.

Ice is water with a certain quantity of the matter of heat, or caloric, abstracted from it. The thermometer stands at the 32d degree of Fahrenheit when water becomes ice. If slowly formed, it is a crystallized body, and is of the specific gravity 0.94, being lighter than water.

Iceland Crystal, *Iceland spar, calcareous spar, crystallized carbonate of lime.* Of this mineral there are several varieties, but the most beautiful crystals are found in Derbyshire. It exists in almost every part of the world.

Iceland Moss, *lichen, icelandicus*, is sometimes used as food; and Berzelius has ascertained that it contains nearly 80 per cent. of starchy matter, with gum, wax, colouring extract, syrup, &c.

Ice-Spar. A sub-species of felspar.

Ichthyocolla, *isinglass, fish glue.*

Idocrase, *vesuvian, crysolite of Vesuvius.* A crystallized substance found in the masses of rock ejected by Vesuvius and Etna. There is a rare blue variety found in Norway. It is used for rings, brooches, and other ornaments, and resembles melanite, or black garnet. It consists, according to Vauquelin, of silica 33, alumina 44, lime 3.8, oxides of iron and manganese 14.

Igasurate of Strychnia.—Messrs. Pelletier and Caventou, the discoverers of strychnia, say that it exists in the seeds of the bean of St. Ignatius, (*strychnos ignatia,*) and other seeds, combined with a peculiar acid, and constituting an *igasurate* of strychnia. The acid they called

Igasuric Acid, which they say resembles malic acid, and is susceptible of crystallization.

Ignis Fatuus, *Jack o' lantern, Will o' wisp.* A luminous appearance frequently seen at night. It is supposed to be occasioned by the extraction of phosphorus from putrefying vegetable substances. The motionless *ignes fatui* seen nightly on the same spots in Italy, are probably caused by the slow combustion of sulphur emitted through the clefts of that volcanic country.

Imponderable Matter. Light, heat, the electric and magnetic fluids, are all treated of by some writers as imponderable matter.

Incandescence. When bodies are rendered luminous by heat without emitting flame, they are incandescent.

Incineration. Combustion for the purpose of obtaining the ashes or fixed residuum of any combustible.

Incombustible Cloth, *asbestos.*

Indigo. This celebrated dye is extracted from a plant called Anil, or the indigo plant.

Indigogene. When the indigo of commerce is exposed to a heat of about 400°, it evolves a beautiful crimson smoke, which may be condensed in crystalline needles. They are supposed to be pure indigo, and have been called *indigogene.*

Inflammable Air, *hydrogen gas.*

Intestinal Concretions, *bezoars.* Concretions found in the stomach and intestines of animals. There have been some instances of such concretions found in females of our own sex. Ambergris is thought by some authors to be a diseased concretion in the whale; and it is supposed that they are common only among the females of all animals, and hence to have some connexion with lactation.

Inulin. A peculiar vegetable principle, resembling starch, extracted from the *inula hellenium,* or elecampane.

Iodates. Substances formed by a union of certain bases with

Iodic Acid, which is a compound of iodine and oxygen.

Iodides, *iodures, iodurets.* Compounds resulting from the action of iodine on metals.

Iodine. An undecompounded principle, discovered in the year 1812. It is obtained from various

sea weeds and from several mineral waters.

IPECACUANHA. The produce of the *calliococca ipecacuanha*. A much-used emetic, the active principle in which is emetine.

IRIDIUM. A metal discovered by Mr. Tennant.

IRON. A well-known metal, and one of the undecompounded elementary bodies of chemists.

IRON-FLINT, *eisenkiesel*. A mineral, consisting of oxide of iron 21.7 and silica 76.8. It occurs in veins of ironstone in many parts of the world.

ISERINE. A hard, iron-black coloured mineral, consisting of iron 48, oxide of titanium 48, and of uranium 4.

ISINGLASS is almost pure gelatine. It is made from certain fish found in the Danube and the rivers of Muscovy. It is put to many uses; among others, in solution, mixed with some balsam, and spread on silk, it forms the court-plaster of the shops.

IVORY. The tusk or tooth of the male elephant, an intermediate substance between horn and bone. It has been found to consist of 24 gelatine, 64 phosphate of lime, and 0.1 carbonate of lime.

IVORY BLACK. The charcoal obtained from burning bones and ivory. It is the basis of several pigments and varnishes.

QUERIES.

To the Editor of The Chemist.

SIR,—What are the principal objections to mica and talc, as substitutes for glass?

Your constant reader,

April 9. A.G.

SIR,—It is said that alum makes beer clearer. Could you, or any of your Correspondents, oblige me by telling in what quantity it must be put to a gallon of the liquor?

Woodford, April 11. E.C.S.

ANSWERS TO QUERIES.

To the Editor of The Chemist:

SIR,—In answer to the inquiries, how to make ginger beer powders, and how to make spruce beer in the best manner, I offer the following, which, if they meet your approbation, you will favour me to insert. I don't know that this method of making spruce beer is the best, but I know it to be very good.

To make Ginger Beer Powders.

Take of

Powder of Loaf Sugar .... 5 scr.
Ginger .... 5 gr.
Subcarbonate of Soda.. 25 gr.

Mix and fold in a blue paper; then take of

Tartaric Acid, powdered, 30 grains.

Fold this in white paper for distinction.

These are sufficient to make half a pint. W. S.

To make Spruce Beer:

Put four gallons of boiling water into a tub or cask with four gallons of cold water, by which you will get the proper degree of heat; then add eight pounds of treacle, and two or three table spoonsful of the essence of spruce: stir these thoroughly well together, and add a quarter of a pint of good yeast. It is now to be kept in a temperate situation till the fermentation is somewhat abated (which will be in about 48 hours), and then bottled off, when in two days it will be fit for use. W. S.

NEW BARK.

THE celebrated traveller, Humboldt, communicated to the Academy of Sciences, on January 3, 1825, that he had received a letter from Dr. Brera, clinical professor at Padua, informing him that a *new bark* had been discovered, to which the name of *quina bicolor* had been given, and which, in very small doses, is a more powerful febrifuge than the best bark.

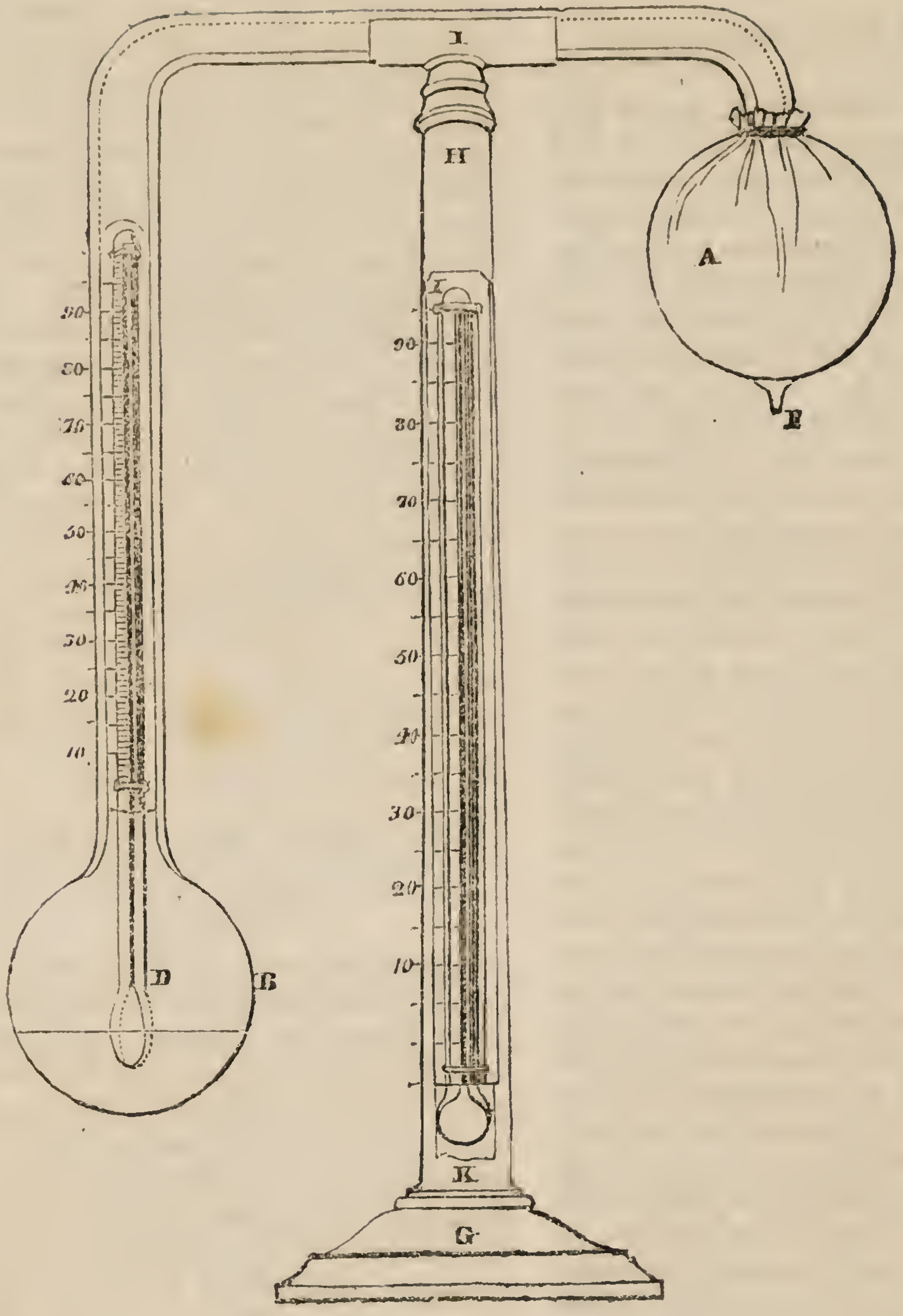
PRINTERS' INK.

(In answer to a Correspondent.)

"Good printers' ink, (says Dr. Ure,) is a black paint, smooth and uniform in its composition, and of a firm black colour. It possesses a singular aptitude to adhere to paper thoroughly impregnated with moisture." The drying oils, and especially nut oil, form the basis of printers' ink. Nut oil is supposed to be the best, though, from its dark colour after being burnt, it is not so proper for red ink. The oil is set over the fire in an iron pot, capable of holding at least double the quantity put in, for the oil swells up, and would be very dangerous were it to boil over. When it boils it is kept stirred by an iron ladle, and if it do not take fire of itself, is set on fire with a piece of flaming paper or wood. It is found that mere boiling without setting it on fire does not give it a sufficiency of the drying quality. The oil is suffered to burn for half an hour or more, and is then extinguished by covering the vessel close, and excluding the air. The boiling is continued with a gentle heat, till the oil has attained the proper consistency. It is necessary to have some more and some less boiled, that thicker or thinner oil may be used, as different purposes may require. That which answers well in hot weather is too thick in cold, and large characters do not require such stiff ink as small ones. The thickest varnish, so the oil is called when burned and boiled, may, when cold, be drawn into threads, like weak glue; and the workmen, taking out small quantities from time to time, judge when it is sufficiently boiled, by its tenacity. Some fine turpentine, or litharge, is added, which is said to make it very difficult to clean the types. Old oil does not require either of these additions; but new oil can hardly be brought into a proper state without one or the other. When the oil has been properly boiled, it is miscible with fresh oil, or with oil of turpentine; and, by the addition of either, it may be brought to a proper consistency. The colouring matter is either lamp black or Frankfort black, but generally the former is used. The proportion of lamp black employed is somewhat more than one-eighth, or 2½ ounces to 16 ounces of varnish. The ingredients are mixed, and ground together on a stone with a muller, in the same manner as oil paints. Our Correspondent complains of printers' ink not being black and becoming illegible. For ourselves, we must say, we scarcely recollect seeing a book in this state, and should be well pleased if the contents of all the works which fell under our notice were as well manufactured as the paper and print.

NEW PLAN FOR MAKING CAST STEEL.

Mr. Thompson, of Pimlico, has taken out a patent for making cast steel in a novel manner. At present the steel is generally enclosed in small perpendicular air furnaces, heated by coke; it is melted in a crucible, usually lifted out of the furnace with labour and difficulty. In Mr. Thompson's method a reverberatory furnace is employed, pit coal is used instead of coke, and the vessel in which the steel is melted is a stationary trough, provided with a socket or hole, so that the steel can be drawn off at pleasure without removing it. The invention only seems to consist in a more convenient mode of performing the operation than is at present in use, but has in its principles so little of novelty or invention, that we wonder how any man can take, or be allowed to take out a patent for such an improvement.



MR. DANIELL'S HYGROMETER.

Our plate represents the hygrometer invented by this gentleman. *a* and *b* are two thin glass balls of an inch and a quarter diameter, connected together by a tube, having a bore about an eighth of an inch. The tube is bent at right angles, over the two balls, and the arm *b c* contains a small thermometer *d e*, whose bulb, which should be of a lengthened form, descends into the ball *b*. This ball having been about two-thirds filled with ether, is heated over a lamp till the fluid boils, and the vapour issues from the capillary tube *f*, which terminates the ball *a*. The vapour having expelled the air from both balls, the capillary tube *f* is hermetically closed by the flame of a lamp. This process is familiar to those who are accustomed to blow glass, and may be known to have succeeded after the tube has become cool, by reversing the instrument and taking one of the balls in the hand, the heat of which will drive all the ether into the other ball, and cause it to boil rapidly. The other ball *a* is now to be covered with a piece of muslin. The stand *g h* is of brass, and the transverse socket *i*

is made to hold the glass tube in the manner of a spring, allowing it turn and be taken out with little difficulty. A small thermometer *k l* is inserted into the pillar of the stand. The manner of using the instrument is this:—After having driven all the ether into the ball *b* by the heat of the hand, it is to be placed at an open window, or out of doors, with the ball *b* so situated as that the surface of the liquid may be upon a level with the eye of the observer. A little ether is then to be dropped upon the covered ball; evaporation immediately takes place, which, producing cold upon the ball *a*, causes a rapid and continuous condensation of the ethereal vapour in the interior of the instrument. The consequent evaporation from the included ether, produces a depression of temperature in the ball *b*, the degree of which is measured by the thermometer *d e*. This action is almost instantaneous, and the thermometer begins to fall in two seconds after the ether has been dropped. A depression of 30 or 40 degrees is easily produced, and I have seen the ether boil, and the thermometer driven down below 0^{0} of Fahrenheit's scale. The artificial cold, thus produced, causes a condensation of the atmospheric vapour upon the ball *b*, which first makes its appearance in a thin ring of dew, coincident with the surface of the ether. The degree at which this takes place is to be carefully noted. A little practice may be necessary to seize the exact moment of the first deposition; but certainty is very soon acquired. It is advisable, when the instrument has been constructed with a transparent ball, to have some dark object behind it, such as a house, or a tree; as the cloud is not so readily perceived against the open horizon. The depression of temperature is first produced at the surface of the liquid, where evaporation takes place; and the currents, which immediately ensue to effect an equilibrium, are very perceptible. The bulb of the thermometer *d e* is not quite immersed in the ether, that the line of greatest cold may pass through it. In very damp or windy weather the ether should be very slowly dropped upon the ball, otherwise the descent of the thermometer will be so rapid as to render it extremely difficult to be certain of the degree. In dry weather, on the contrary, the ball requires to be well wetted more than once, to produce the requisite degree of cold. If at any time there should be reason to suspect the accuracy of an observation, it may easily be corrected by observing the temperature at which the dew upon the glass again disappears: the mean of the two observations (whose errors, if any, will lie in contrary directions,) will give the true result. It is obvious that care should be taken not to permit the breath to affect the glass. With these precautions the observation is simple, expeditious, easy, and certain.

ATTRACTION.

To the Editor of The Chemist.

Sir,—In No. 48 of The Chemist, a Correspondent imagines that it is not the attraction of cohesion which causes two pieces of lead (having their surfaces smoothly flattened) to adhere so firmly, but that it is owing to the pressure of the air. I think that the following experiment will convince him that his theory is incorrect:—Let him take two pieces of glass, about half a foot square, drop a little oil on each of their surfaces, and press them together; he will find, that although a much greater surface is subjected to the pressure of the air, they will not cohere so strongly as the pieces of lead, there being less attraction between them. I do not say that pressure of the air may not contribute to the adherence of the two pieces of glass or lead, but it is not the principal cause of the phenomenon.

Yours, respectfully,

An Infant Chemist.

LECTURES AT THE ROYAL INSTITUTION.

LITHIUM. CALCIUM.

Lecture 32. For a very long time potassa and soda were the only alkalies known to us; but in 1813, Mr. Arfwedson, on analyzing a mineral called petalite, discovered another alkali, to which the name of lithia, derived from its origin, as a component part of a stone, has been given. He took it for soda, but, on endeavouring to form with it a sulphate of soda, he found that it required a greater quantity of acid than that alkali to neutralize it. Thus 100 parts of soda united with the acid yielded 225 parts of salt, but 100 of lithia yielded upwards of 300 parts. He was thus led to suspect that it was a different alkali from either soda or potassa; and on pursuing his inquiries, became fully convinced that it possessed peculiar properties, and his observations have since been verified by other chemists. It is an instance of the advantages resulting to us in our inquiries, from adopting the doctrine of definite proportions. It was only from the lithia taking a greater quantity of the acid than soda, that Mr. Arfwedson was led to suspect its different nature, and to conclude that it was neither potassa nor soda. Eighteen parts of lithia require 40 of sulphuric acid, 22 of carbonic acid, and 54 of nitric acid, to neutralize them; while, to neutralize the same proportion of these acids, we must employ forty-eight of potassa, and thirty-two of soda. Lithia is obtained by reducing the petalite to a fine powder, fusing it with half its weight of potassa, and dissolving the fluid mass in muriatic acid. It is then to be filtered and evaporated to dryness, and the mass digested in alcohol, which dissolves only muriate of lithia, which is decomposed by carbonate of silver, when a carbonate of lithia is obtained, which may be reduced to lithia, like the other carbonates of the alkalies. On Mr. Arfwedson's discovery being known in England, Sir Humphry Davy supposed that lithia would have a metallic base, like the other alkalies, and on subjecting it to the action of the Voltaic pile, he obtained proofs that the base of the alkali was a metal of a bright white colour, the lithia being an oxide of this metal, as the other alkalies are oxides of potassium and sodium. The properties of *lithium*, however, have not yet been accurately investigated. Lithia resembles, in its properties and *habitudes*, soda and potassa. There are some distinctions between them; the carbonates of lithia being, for one thing, very insoluble in water. The chloride of lithium, too, is decomposed when strongly heated; it loses chlorine, absorbs oxygen, and becomes highly alkaline. It tinges the flame of alcohol of a red colour, which the other chlorides do not. Lithia occurs in the petalite and *spodumene*, the former containing about three, and the latter about five per cent. of the alkali.

Calcium.—It has been long suspected that the earth called lime contains a metallic base, but it was only after the discovery of the metallic bases of the alkalies that this suspicion appeared warranted. Berzelius and Professor Hiesinger had mentioned, from the analogy between lime and the alkalies, the probability that its base was a metal; and Sir H. Davy succeeded in obtaining an amalgam of the basis of lime, to which he gave the name of Calcium. Of the metal, however, nothing is known, because most of the experiments to obtain it, except amalgamated with mercury, have failed. In the experiment which succeeded best, a white shining metallic substance was obtained, and from this, as well as from analogy, which confirms this view, there is now no doubt but that lime is a compound of this peculiar metal and oxygen. By having recourse to the combinations of the earth with acids, we find that 28 of lime require 40 of sulphuric acid for saturation; and as 32 of soda and 40 of potassa are required for the same purpose,

and each of these contains 1 of oxygen, it is inferred that lime is a compound of 8 of oxygen and 20 of lime.

LIME exists in nature in great abundance, in different forms, principally, however, in combination with carbonic acid, constituting the different varieties of chalk, marble, and limestone, as well as being the basis of several other substances, so as to form a great part of the mineral crust of the globe. It has been also found pure, or caustic, though in combination with water, and existing as a hydrate in a lake at the foot of the Appenines. In this state it is probably a volcanic production. The most usual source of lime, however, is the carbonates, such as chalk, limestone, and marble. If they are heated the carbonic acid is expelled, and the lime remains pure. Thus the ordinary mode of manufacturing lime consists in breaking the carbonates into pieces, kindling some coals at the bottom of a kiln, and then throwing in alternately chalk or limestone, and coals or some other fuel, which drives off the carbonic acid, and the lime remains. If this is done with marble, the lime is found to be quite pure, and this may be known by testing it with muriatic acid. If not sufficiently calcined, it then effervesces, and if it has been sufficiently calcined it does not effervesce. The quantity of heat evolved, also, by slaking it, is a good test; and its purity may be judged of by placing a small quantity on the skin, and dropping water on it.

Lime, when pure, is solid, white, and caustic, turning yellow turmeric paper red, and vegetable blues green, like the most powerful alkali. It requires a temperature much higher than that of our best furnaces to fuse it by itself; but it may be fused by the heat of the Voltaic battery, or that of the oxy-hydrogen blow-pipe. Mixed with other earths, however, it fuses very easily, forming, with them, a sort of glass, and it is therefore much employed in the process of smelting, as a flux to purify the metals. It absorbs moisture very rapidly, and is converted into a hydrate, containing one proportional of water. This hydrate, which is caustic and alkaline, like dry lime, absorbs carbonic acid from the atmosphere, loses its water, ceases to be acrid and caustic, and loses all its alkaline properties. Pure lime absorbs water with chemical action, as is proved by the heat evolved, which in many cases is sufficient to char wood, or set it on fire, producing serious accidents. Phosphorus and sulphur may both be inflamed by it. Mr. Faraday here slaked a small quantity of caustic quick lime, and it kindled both phosphorus and sulphur, which he placed among it. A greater quantity of water dissolves lime in small quantities, forming lime-water, the lime dissolved not being above the 750th part of the water. It is remarkable of this solution, as has been observed by Mr. Dalton, and verified by Mr. Phillips, that water at 212^{0} only dissolves half the quantity of lime which water at 32^{0} will do, showing, contrary to experience in other cases, that the solvent power of water is decreased by heat. Lime-water is perfectly clear and limpid, and possesses all the alkaline properties of lime itself, and has even a greater effect on colours. If exposed to the air it absorbs carbonic acid; the carbonate of lime forms a pellicle on the surface, which, if removed, is succeeded by others, till the whole of the lime is converted into an insoluble carbonate, and thus separated from the water. Lime-water is a very good test, on this account, of the presence of carbonic acid; wherever it is present the lime-water absorbs it and becomes turbid. Mr. Faraday burnt a taper in a glass vessel containing a small quantity of lime-water, and in a short time the water became turbid; he then breathed in lime-water, or rather blew in it, and the same effect took place, proving that carbonic acid was produced both by combustion and respira-

tion. If lime-water be placed in the receiver of an air-pump, containing another vessel with sulphuric acid, the water is slowly evaporated from the lime, and the lime obtained crystallized. Lime-water is used in tanning to clean the skins; in sugar baking, to separate the crystals of sugar; in soap-works, in bleaching, and in the manufacture of ammonia.

When lime is heated in contact with oxygen, it combines with more oxygen, and forms a peroxide of calcium; but this, which is of no importance, will be hereafter adverted to, when oxygenated water is brought under notice.

Lime and chlorine form chloride of calcium. It is obtained either by heating lime in chlorine, or by adding muriatic acid to an excess of carbonate of lime, then evaporating the muriate to dryness and exposing the dry mass to a red heat in close vessels. A true chloride of calcium, formerly called *muriate of lime*, is obtained, and consists of 20 lime and 36 chlorine, its equivalent being 56. These proportions accord strictly with the equivalent number assigned to lime and to calcium, and with what is supposed from analogy to be the composition of the earth. The chloride has a great affinity for water, absorbing it rapidly. From its aqueous solution crystals may be obtained, which are the chloride combined with six proportionals of water; and these crystals, when dissolved in water, produce a great degree of cold. When the chloride has been fused, and then dissolved in alcohol, a great heat is produced. Under the influence of great heat, oxygen separates the chlorine from the lime, and the alkaline earth is produced. Of late it has been stated that chloride of calcium is a great stimulus to vegetation; that plants watered with it in solution, produce a great abundance of flowers, fruits, and roots. This is said to have been ascertained in Italy, and experiments are now going on in the gardens of the Horticultural Society, to ascertain if these assertions be correct. The chloride is also used to dry gases, but it absorbs ammonia very rapidly, and therefore in drying gases this must be taken into consideration.

Chlorine combines also with lime, and forms a bleaching powder, or, in solution, a bleaching liquid. It is obtained in great quantities for manufacturing purposes, by passing chlorine into a hydrate of lime in fine powder, disposed in trays or leaden chambers, the chlorine being produced by the usual means of black oxide of manganese and muriatic acid; the lime absorbs the chlorine. When the chloride is dissolved in water, only half the lime is taken up and half is thrown down. When heat is applied to chloride of lime, oxygen is driven off, and chloride of calcium remains. The bleaching power of this substance is much assisted by acids, owing apparently to their affinity for lime, which, combining with them, leaves the whole action of the chlorine to be exerted on the colouring matters. The test for the value of this bleaching mixture is the quantity of indigo of which it can destroy the colour. This substance was formerly, and is now very often called *oxymuriate of lime*, and consists of 1 proportional chlorine to 3 or 4 of lime.

The *chlorate of lime*, or the compound of chloric acid and lime, as well as the iodide of lime, are both known, but neither of them is of any importance.

Nitrate of lime is of importance, being formed in the manufacture of artificial nitre. Lime is the base which attracts the nitric acid when formed, and promotes its formation; and to this is added carbonate of potash, when nitrate of potash and carbonate of lime are produced, the nitrate remaining in solution and the carbonate being precipitated. Nitrate of lime is composed of 28 lime, 54 nitric acid, the nitrate being represented by 82. After being heated a considerable time, this salt remains phosphorescent for two or three hours, and is known under the

name of *Baldwin's phosphorus.* It was one of the substances with which the older chemists wrought what they called a chemical miracle. To it in solution they added a carbonate of potash, also in solution, and in a little time the two liquids formed a solid, concrete, strong mass; by our better knowledge of chemical affinity, this miracle is now easily explained, and is a miracle no longer.

The sulphurets of lime are analogous to the sulphurets of the alkalies. Mr. Herschel has shown that *hyposulphurous* acid may be obtained in combination with lime, forming a *hyposulphite* of lime; but neither this nor the *sulphite* is of any importance that we at present know of.

Sulphate of lime occurs native in many places, combined with water, and with many other mineral bodies. It is a compound of 28 lime, 40 sulphuric acid, making the equivalent of sulphate of lime 68. It absorbs two proportionals of water, 18, to form the hydrate, which is consequently represented by 86. When the artificially produced, or the native sulphate is exposed to heat, they lose water and fall into powder, which is then called *plaster of Paris;* and if this be mixed with water, as the action takes place, the sulphate crystallizes, and forms a hard sonorous mass: it is therefore an admirable substance for taking casts, and for other such purposes, as it runs in its liquid state into every indentation, and then grows hard as a stone. The further consideration of the compounds of calcium in the next lecture.

BRONZE STATUES.

The preparation of an alloy homogeneous and equal in all its parts, for the purpose of casting statues and monuments, is a chemical, or rather metallurgical operation of very great difficulty. In France, where this art has of late years been extensively practised, there are three instances of failure in very modern times. During the reign of Louis XIV. the most celebrated statuaries in bronze were brothers of the name of Keller, and their works were completely homogeneous in the composition of the alloy, and of great beauty of execution. More lately, and even long since theoretical chemistry has been cultivated to a great extent in France, this branch of art has been practically less attended to, or less known, and produced the following failures:—

STATUE OF DESAIX.

The execution of this statue was undertaken by contract, and the sum to be paid for it was 100,000 francs, exclusive of the bronze. The contractor entered into an agreement with a person accustomed to cast bells and such things, who undertook to perform the whole for 20,000 francs; but that he might be as economical as possible, he bargained that the sculptor was not to interfere with his modelling. The first attempt at casting completely failed, owing to the frame giving way in which the sand was put, and a considerable quantity of metal was lost. The artist next attempted to cast it in separate pieces, but from not ascertaining that all the portions of the metal were mixed in the same proportions, and from not taking the contractions on cooling into consideration, the pieces were all of different qualities, and did not unite well with each other. He did indeed unite them, but the proportions were so altered, the faults being so great, that they could not be repaired by the chisel, and the monument, as a work of art, was a disgrace to the city of Paris. At a subsequent period it was removed, and afterwards recast to form the statue of Henry IV. in making which almost as great errors were committed. At the erection of the CELEBRATED COLUMN IN THE PLACE VENDOME, similar faults were committed. This column was erected by order of Buonaparte, in commemoration of the victories of the French armies, and it was cast out of cannon taken

from the Austrians and Russians in 1805. The whole weight of the different pieces of bronze composing it was 900,000 *kilogrammes*, or very nearly 2,000,000 lbs. avoirdupois. The contract for the performance of the work was made with an iron founder, who undertook the whole, carving and all, for 1 *franc* a *kilogramme.* M. Darcet, the celebrated chemist, tendered some good advice on the occasion, which was rejected, and the contractor had a foundry built at a considerable expense. He employed a furnace for melting iron; and being ignorant of the fusion of bronze, he failed in his first attempts to cast the large pieces for the base of the column. At each operation he altered the proportion of the alloy, by oxidizing the tin, the lead, and the zinc, the oxides passing into scoria, or being partly carried off by the burning air. He did not perceive this, and delivered the different pieces of different qualities, but all of them contained a greater proportion of copper than the bronze of the guns. When the column was about two-thirds finished, he found his supply of metal exhausted; and so sure had he been of having enough, that he had previously sold part of the 10 per cent. allowed him for waste, under the idea that it would be more than sufficient. Being obliged to complete the work with the quantity of metal delivered to him, he was placed in a disagreeable situation. Under these circumstances he endeavoured to cast the white metal obtained by reducing the scoria, and a quantity of old brass he purchased at a low price. The castings he obtained by mixing these materials were full of bladders and spotted with lead; they were at first of a dirty grey colour, and afterwards became black. Such defective work could not pass, the labours of the undertaker were put a stop to, his foundry was sealed up, and the man ruined.

By dint of reclamations he procured the appointment of a commission to examine his accounts. The commissioners wished to know the proportions of the different metals in the guns delivered to him; but this point had not been ascertained, and therefore the most important element for coming to a correct conclusion could not be obtained. The weight of each piece of casting delivered by him was known; and by taking morsels from them all, and melting them into one piece, an ingot was obtained representing the mean composition of the whole column. After ascertaining this, and knowing the general proportion of the alloys of which cannon are constructed, the commissioners agreed in opinion, that the mean alloy of the column was equal to that delivered to the contractor. By analyzing the different pieces, it was found that the large pieces of the pedestal contained only 6 per cent of alloy, while the small pieces of the shaft and column contained 21. It was therefore evident, that the contractor, not understanding the nature of bronze, had refined his alloy in the first instance by repeated meltings; and having thus diminished very much the total weight, was obliged to have recourse to the means already described. At the commencement of his operations he had delivered the pieces with too much copper, and at the end with too little. The pieces were, after all, so badly executed, that above 140,000 lbs. of bronze were cut away by the sculptor, who was, morever, paid 300,000 francs for his labour.

THE POOR MAN'S BAROMETER.

Both the *convolvolus* and the *pimpernel* (anagallis) fold up their leaves on the approach of wet weather. The latter is called the poor man's weather glass. In the same manner the different species of *trefoil* contract their leaves at the approach of a storm, and they have been named the *Husbandman's Barometer*. Chickweed is another plant, which answers the same purpose. When the flower expands boldly and fully, no rain will hap-

pen for four hours or upwards: if it continues in that open state, no rain will disturb the summer's day. When it half conceals its miniature flower, the day is generally showery; but if it entirely shuts up or veils the white flower with its green mantle, let the traveller put on his great coat, and the ploughman, with his beasts of draught, expect rest from their labour. But these, and a multitude more of such observations as these are of no use, and can give but little pleasure to the inhabitants of so crowded a city as London. Perhaps, indeed, after the reviving effects of pure air and a clear sky, the dwellers in thronged and close pent up streets suffer no greater privation than the want of every opportunity of observing the numerous little facts which are connected with the *habitudes* of vegetables, insects, and animals.

ANTIDOTES.

Mr. J. Murray has ascertained, that ammonia is an effectual antidote to prussic (hydrocyanic) acid; and that acetic acid (vinegar) counteracts the effects of opium.

CARMINE.

It is said, that there is a great deal of mystery hanging over the manufacture of this beautiful colouring matter, partly because the theory is not exactly understood, and partly because those who practise the art of making it acquire a kind of skill or acuteness, which they cannot or will not describe. In general it is stated, that alum is necessary as a basis; but Messrs. Caventou and Pelletier have asserted the contrary, and some methods of making it seem to justify their opinion. Other salts, as well as alum, serve the purpose of heightening the colour, and of precipitating it; and they do this, according to the opinion of these chemists, by the action of their excess of acid on the animal matter of the cochineal. Our readers will probably be aware, that the colouring matter of all carmine is cochineal. The following is said to be the method employed for making *The Superfine Carmine of Amsterdam.*

Six pails of river water are boiled in a cauldron, and at the moment it begins to boil two pounds of cochineal, in fine powder, are added to it. When it has boiled two hours, three ounces of pure nitre, and, an instant afterwards, four ounces of acidulated oxalate of potassa, are added to it. It is boiled ten minutes longer; the cauldron is then taken from the fire, and the whole allowed to remain undisturbed four hours. The water is then drawn from the carmine by means of a syphon, and is distributed into several earthen pans, which are allowed to remain for three weeks. In a short time, a small pellicle of mouldiness forms on the surface, which is removed by a piece of sponge and a whalebone. The water is then drawn off from above the carmine, which is deposited in and adheres to the bottoms of the pans, by means of a syphon. The colour is afterwards dried in the shade, and is so very brilliant, that it dazzles and tires the eye.

EFFECT OF HEAT AND COLD ON METALLIC MONUMENTS.

In erecting the celebrated column to commemorate the victories of the French armies, in the Place Vendome, at Paris, the effect of the dilatation by heat was not taken into account, and all the pieces of bronze composing the shaft closely connected together, form a single band round a strong shaft in stone, to which they are attached by numerous iron cramps. When the sun's rays strike the column, it is heated only on one side from top to bottom, the metal is unequally expanded, and tends to separate into pieces, and to separate from the masonry. In the summer evenings the fall of temperature is rapid and considerable, and the contraction of the metal acts in a

direct opposite direction from its expansion. When these changes take place loud noises are heard in every part of the column, and cracks are produced, which diminish its solidity. Napoleon Buonaparte pointed out a means of avoiding this, which was to form the whole shaft of cylinders, connected at the edges by means of moveable gudgeons.

LIGHTS OF NAPHTHA.

M. Hecker, comptroller of salt mines in Gallicia, has discovered that Naphtha burns better than any oils in a mine where foul air is prevalent, and that it is less injurious to the health of the workmen.

TO CORRESPONDENTS.

Our Grosvenor-street friend, "In a Rage," must, we should suppose, be thoroughly aware that no author, either living or dead, ever confines himself to recording his own experiments. Nor do we believe there is any chemist or philosopher of the day who has compiled a book, and has verified every experiment he has borrowed from the researches of others. We must always except the illustrious Dr. Kitchiner, who has the merit of having prepared every dish, and eaten his way through it, which is described in his book on gastronomy. He is a gentleman of singular industry as well as erudition, and we cannot lay claim to any merit like his. Our Correspondent, therefore, must excuse us for not having verified the experiment to which he alludes, when we transcribed it from Parke's Chemical Catechism. At the same time, the fact of the oxide of manganese changing its colour is so well attested by Dr. Ure, Sir Humphry Davy, and other eminent chemists, the baronet having indeed accounted for it by supposing that it is owing to the gradual conversion of one oxide of manganese into the other, by the absorption of oxygen from the atmosphere, that we cannot for one moment doubt the fact; and must rather suppose that our Correspondent has failed from some oversight of his own, than that Mr. Parkes should have committed an error. The presence of atmospheric air is necessary; and if our Correspondent performed the experiment in close vessels, he would fail. Instead of nitrate of potash, Dr. Ure recommends pure potash. We trust this explanation will be satisfactory to our Correspondent, and that he will be sensible, without any further remark from us, that his EPITHET was misapplied.

"A. G." will find one of his Queries already answered at p. 114, vol. ii.

We are not at present acquainted with any PREPARATION having the effects inquired after by "T. B." though we suppose careful drying will answer his purpose. We will, however, if he does not say NO, insert his Query in our next.

The Index to Vol. ii. is unavoidably postponed till next week.

Communications from "H. R." and from "An Apprentice to a Vellum Binder," shall be attended to in our next.

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B. BENSLEY, BOLT-COURT, FLEET-STREET.